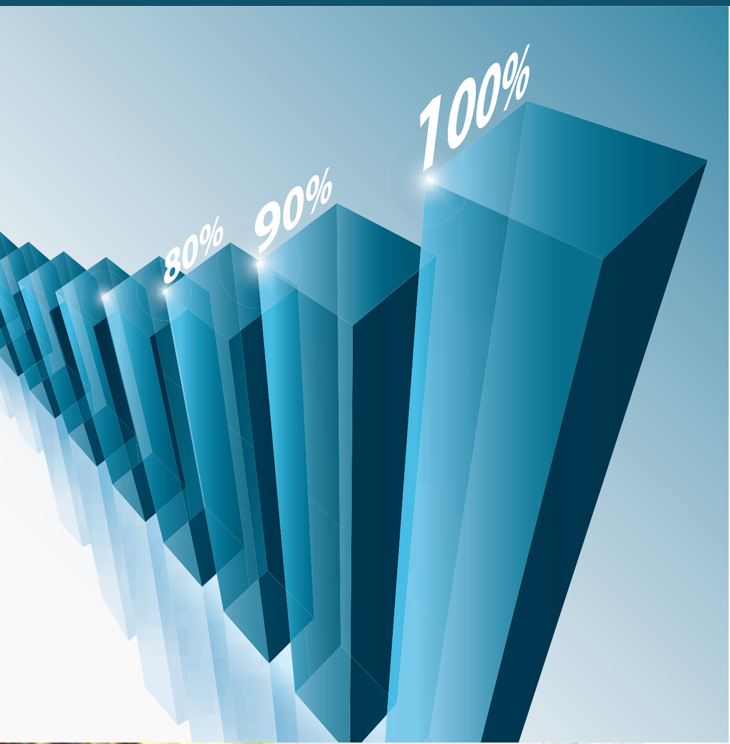
International Telecommunication Union



Measuring the Information Society



2012

International Telecommunication Union

Measuring the Information Society

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Foreword



It is my pleasure to present to you the 2012 edition of *Measuring the Information Society*. Now in its fourth year, this annual report draws on innovative and authoritative benchmarking tools developed by ITU to monitor information-society developments worldwide as well as to provide valuable information for use in formulating evidence-based policies and in effective peer learning.

The report presents the *ICT Development Index (IDI),* which ranks countries' performance with regard to ICT infrastructure and uptake, and the *ICT Price Basket (IPB)*, a unique metric that tracks and compares the cost and affordability of ICT services. This edition also features new data series and analyses concerning revenue and investment in the ICT sector, and proposes a new methodology using non-conventional data, to measure the world's telecommunication capacity.

The past year has seen continued and almost universal growth in ICT uptake. Much of this enhanced connectivity is due to the rapid uptake – a 40 per cent rise in 2011 – of mobile-broadband subscriptions, to the point where there are now twice as many mobile-broadband as fixed-broadband subscriptions. The surge in numbers of mobile-broadband subscriptions in developing countries has brought the Internet to a multitude of new users. The report nevertheless notes that the prices for ICT services remain very high in many low-income countries. For mobile broadband to replicate the mobile-cellular miracle, 3G network coverage has to be extended, and prices have to go down further.

Indeed, the disparities in ICT development between countries remain substantial, with IDI values that are on average twice as high in developed compared to developing countries.

I trust that the data and analysis contained in this report will be of great value to the ITU membership and others working towards building an inclusive global information society. I am pleased to note that, overall, considerable strides have been made since the launch of the 2011 edition.



Brahima Sanou
Director
Telecommunication Development Bureau (BDT)
International Telecommunication Union

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The report includes data from Eurostat, OECD, IMF, UNCTAD, the UNESCO Institute for Statistics, the United Nations Population Division and the World Bank, which is greatly acknowledged.

ITU also appreciates the cooperation of countries that have provided data included in the ICT Development Index and ICT Price Basket.

The report was edited by the ITU English Translation Section, led by Anthony Pitt. The desktop publishing was carried out by Nathalie Delmas, and the cover was designed by Céline Desthomas and Jie Huang. Administrative support was provided by Herawasih Yasandikusuma.

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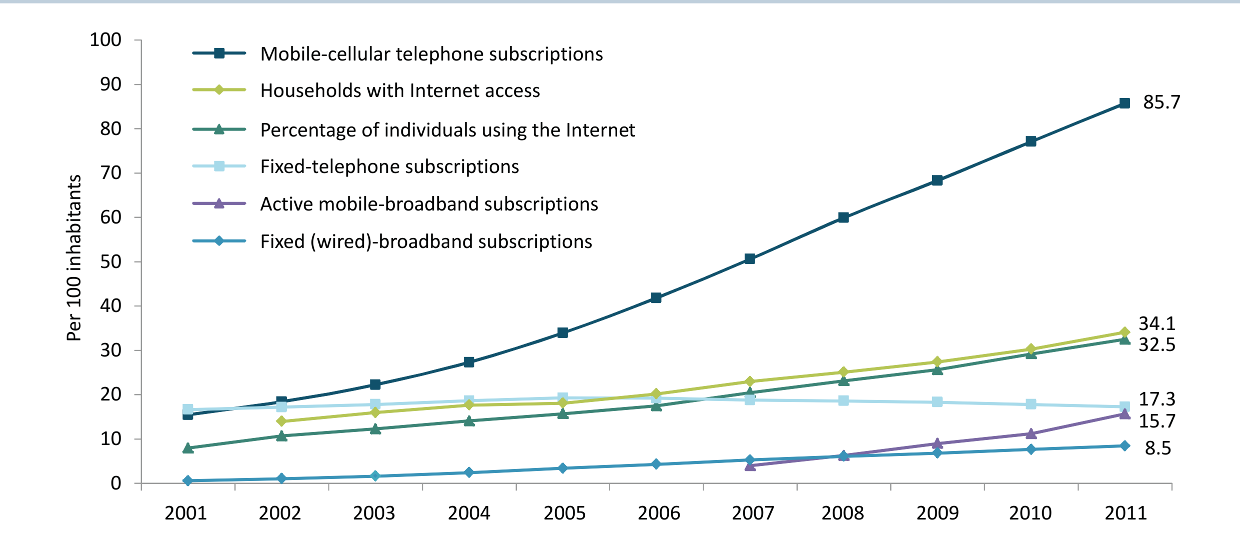
Chapter 1. Introduction

Overview of recent ICT developments

New information and communication technologies (ICTs) continue to penetrate countries in all regions of the world, as more and more people are getting connected. The past year has seen persistent growth in ICT uptake worldwide, with an increase in all key indicators except the number of fixed-telephone lines, which has been in decline since 2005 (Chart 1.1). Indeed, more and more countries are reaching a critical mass in terms of ICT access and use, which accelerates ICT diffusion and further boosts demand, driven by the spread of mobile Internet.

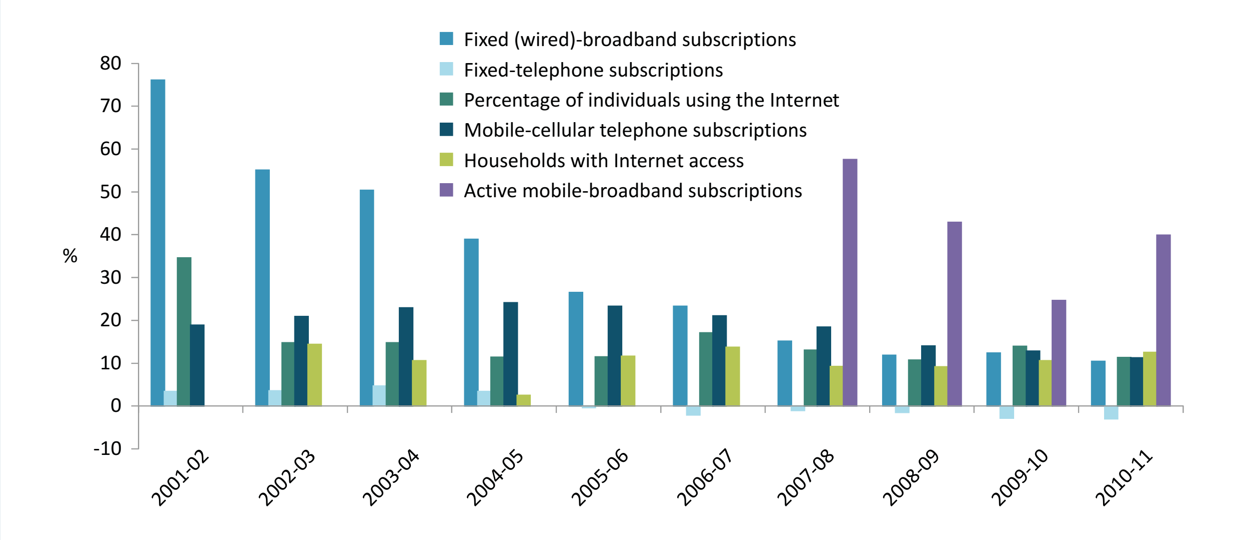
Based on the ubiquity of mobile telephones, the introduction of mobile-broadband services in the majority of countries in the world, coupled with the availability of smartphones and tablet computers, has sparked a steep increase in mobile-broadband subscriptions, which have experienced average annual growth of 41 per cent since 2007 (see Chart 1.2). The trend away from traditional mobile-cellular services, such as voice and sms, towards mobile-web services and uptake is gradually shifting mobile traffic volumes from voice to data, with all this implies in terms of speed, price, available spectrum, revenue and investment.[1] At the same time, fixed-broadband Internet is still growing continuously – albeit at lower rates in developing countries, where it is

Chart 1.1: Global ICT developments, 2001-2011



Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.2: Global ICT developments, annual change, 2001-2011



Source: ITU World Telecommunication/ICT Indicators database.

mobile-broadband services that are fulfilling the demand for Internet access.

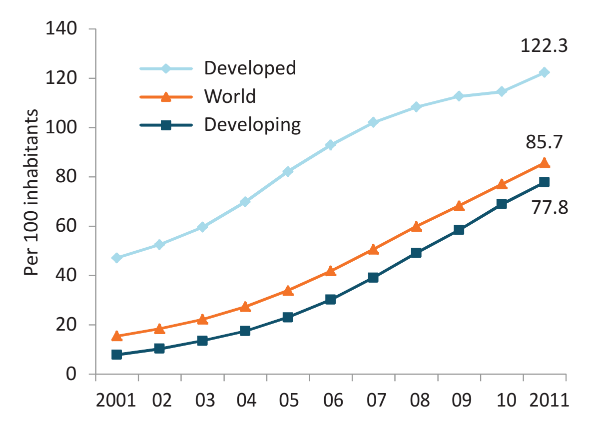
The following sections provide a brief overview of key ICT services and their developments over the past year.

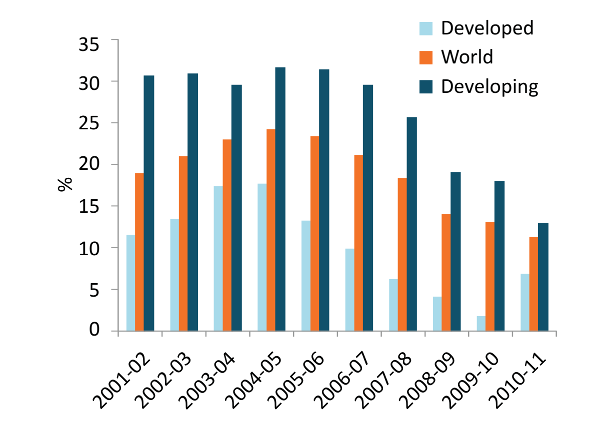
Mobile sector

Between 2010 and 2011, mobile-cellular subscriptions registered continuous double-digit growth in developing-country markets, but an overall slowdown in comparison with previous years (Chart 1.3). The number of mobile-cellular subscriptions increased by more than 600 million, almost all of them in the developing world, to a total of around 6 billion, or 86 per 100 inhabitants, globally. China alone is home to 1 billion subscriptions, and India is expected to hit the 1 billion mark in 2012. Mobile-cellular penetration increased by 11 per cent worldwide, compared to 13 per cent the previous year. In developing countries, growth was 13 per cent (as against 18 per cent the year before), and penetration stood at almost 78 per cent by end 2011. The 7 per cent rise in mobile-cellular subscriptions in developed countries – yielding a penetration rate of 122 per cent – is largely due to a strong increase in two of the largest markets, the United States and the Russian Federation. In particular, the United States, which was characterized by relatively low penetration rates (relative to other developed countries), experienced strong growth of almost 20 per cent over the past year, taking it past the 100 per cent penetration threshold. Excluding those two countries, growth in the developed world stood at no more than 3 per cent, clearly reflecting saturation in the mobile-cellular market.

The strong growth in the mobile sector in developing countries has been driven by increased competition and affordable services and devices. Mobile-cellular telephony continues to replace fixed-line services, the latter still being dominated by the incumbent operator in many developing countries. In particular, the introduction of prepaid services in developing countries has made mobile communication accessible to many low-income, low-user segments who cannot afford, or do not qualify for, postpaid subscriptions. Indeed, today more than 70 per cent of all mobile-cellular subscriptions are prepaid (and as many as 87 per cent in developing countries). As Chapter 3 of this report shows, prices for mobile-cellular services have gone down by 37 per cent over the past four years; and while prices have stabilized at very low levels in the developed world since 2010, they continue to fall in the developing countries. Overall, the increasing number of service providers has led to sometimes fierce competition in the sector and driven down consumer prices significantly, which has been a key factor in the spread of mobile-cellular services.

Chart 1.3: Mobile-cellular subscriptions, 2001-2011, world and by level of development, penetration (left) and annual growth (right)





Source: ITU World Telecommunication/ICT Indicators database.

Growth in the mobile market will continue to be driven by prepaid services, more affordable devices, and the increasing availability of mobile-broadband services. Over the next few years, the most significant trend will be a shift from mobile voice to mobile data traffic as more and more people subscribe to wireless-network services for accessing the Internet.

Broadband (fixed and mobile)

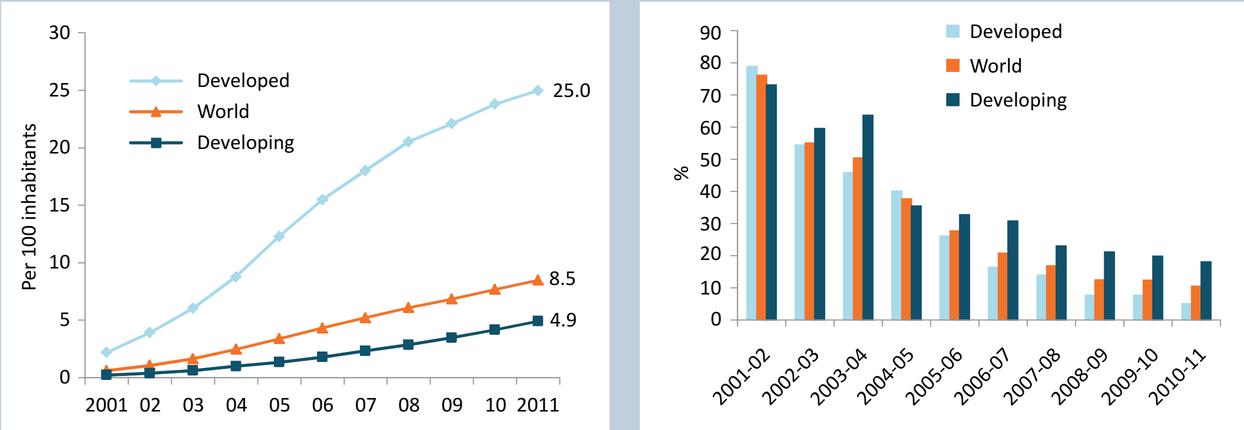
Looking at the broadband markets, uptake of both fixed (wired)-broadband and mobile-broadband services has continued to grow worldwide. By end 2011, the number of fixed (wired)-broadband subscriptions had climbed to almost 600 million, corresponding to a global penetration rate of 8.5 per cent (Chart 1.4). This compares with around 530 million, and 7.7 per cent penetration, a year earlier. At the same time, the number of active mobile-broadband subscriptions grew by 40 per cent between 2010 and 2011, to almost 1.1 billion by end 2011. This represents a penetration rate of 16 per 100 inhabitants globally, as against 13 a year earlier (Chart 1.5). Today, there are almost twice as many mobile-broadband as fixed-broadband subscriptions. Europe continues to be the leading region when it comes to broadband uptake (Chart 1.6).

Mobile broadband continues to be the ICT service displaying the sharpest growth rates. Between 2010 and 2011, growth continued at a high rate of 40 per cent globally, 23 per cent in the developed world and 76 per cent in developing countries. Contrary to mobile-cellular penetration, no saturation point has yet been reached for mobile-broadband penetration, and growth is expected to continue at double-digit rates over the next few years.

The steep increase in mobile-broadband subscriptions reflects the surge in handheld devices capable of accessing the Internet (smartphones, tablet computers), coupled with the launch of high-speed mobile networks and services (3G and above) in developing countries. As operators upgrade networks and expand service coverage, they reach an increasing proportion of the world's urban and rural population. By end 2011, more than 160 economies worldwide had launched 3G services commercially, and 45 per cent of the world's population was covered by a 3G mobile network (Chart 1.7).

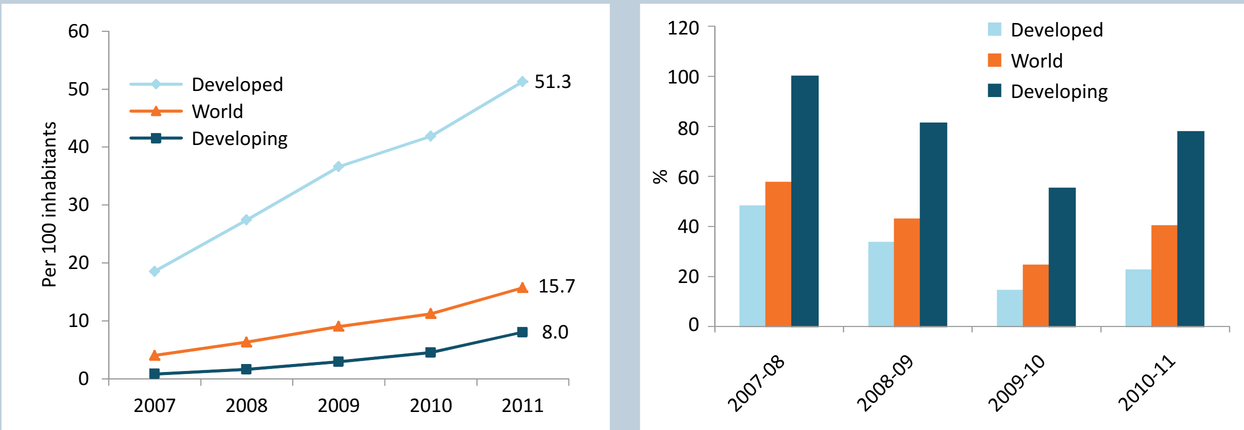
The emergence of mobile Internet services (both prepaid and postpaid) has played a key role in the surge in numbers of mobile-broadband subscriptions in developing countries, bringing Internet to a large number of users who have limited access to fixed-broadband services. As Chapter 3 of this report shows, mobile-broadband services (both prepaid and postpaid) are on average more affordable than fixed-broadband services, although the price differences are not huge, and are less pronounced in developed countries. Nevertheless, mobile broadband is still expensive in most developing countries, especially for high-volume users. Indeed, in many countries, the price of mobile-broadband services is comparable to that

Chart 1.4: Fixed (wired)-broadband subscriptions, 2001-2011, world and by level of development, penetration (left) and annual growth (right)



Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.5: Active mobile-broadband subscriptions, 2007-2011, world and by level of development, penetration (left) and annual growth (right)



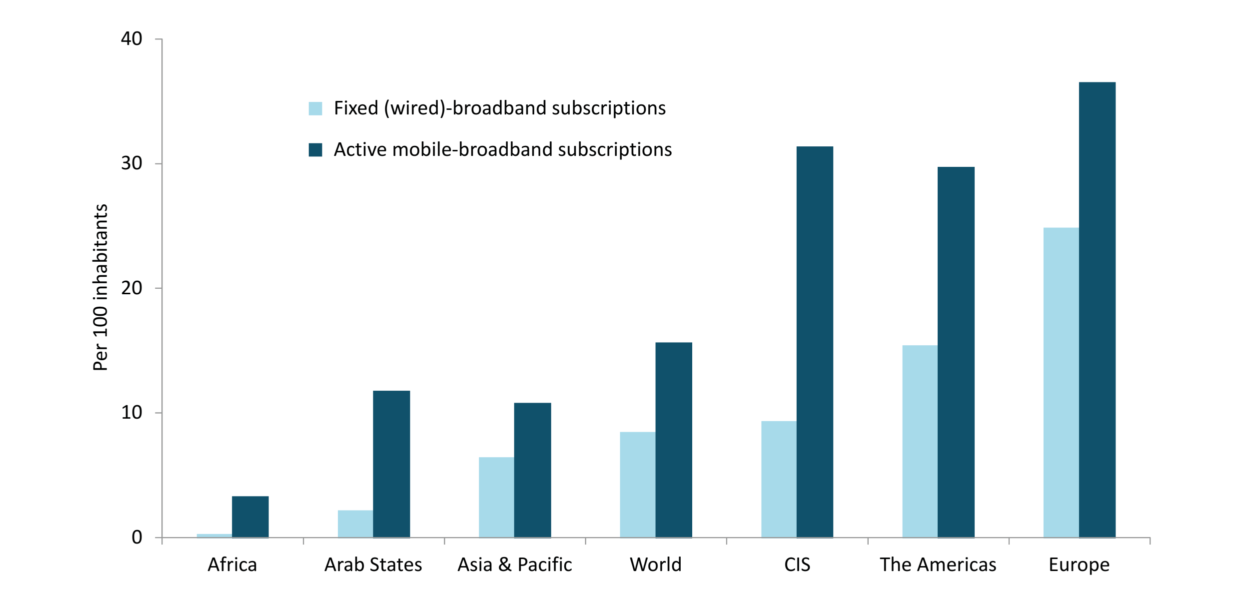
Source: ITU World Telecommunication/ICT Indicators database.

of fixed-broadband services, and remains beyond the reach of many of the low-income segments in developing countries. The introduction of prepaid mobile-broadband services addresses this problem, by offering a relatively affordable solution for low-volume users and people who do not qualify for postpaid subscriptions.

In most developing countries, the market for mobile-broadband services is still in its infancy, and operators are offering a variety of solutions geared to different market segments. It may be anticipated that, once the high-end segment is covered, a number of offers targeting low-income, low-usage segments will emerge in the near future, thus bringing Internet to an increasing number of people.

Moreover, in developing countries, high growth in smartphones and (affordable) tablets is to be expected over the next couple of years. For example, China, the biggest market globally, has also just become the biggest smartphone market – overtaking the United States – and high growth rates will continue in the coming years, driven by low-cost handsets and service offers. This, as well as the increase in other big emerging markets (such

Chart 1.6: Fixed (wired)- and active mobile-broadband subscriptions, by region, 2011



Source: ITU World Telecommunication/ICT Indicators database.

as the BRICS countries), will have a significant impact on the number of mobile-broadband subscriptions and Internet users and, coupled with the increase in mobile video applications, will reinforce the shift from mobile voice to mobile data traffic. As a result, significant upgrades of networks, higher speeds and more spectrum will be required, all warranting sustained investment flows in the sector.

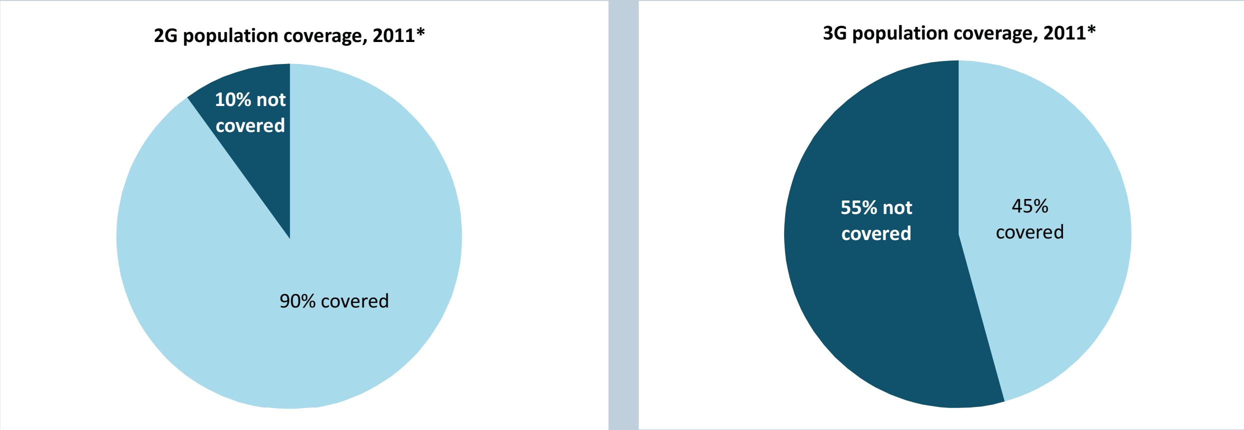
Fixed-broadband penetration, on the other hand, is growing more slowly, by 10 per cent worldwide, 5 per cent in developed countries and 18 per cent in developing countries over the past year. The number of subscriptions has increased from 530 to 590 million, attaining a global penetration rate of 8.5 per cent, with 25 per cent penetration in the developed countries as compared with almost 5 per cent in developing countries. There are no signs of saturation yet, and fixed-broadband penetration is expected to continue progressing over the next few years.

In comparison with mobile-network infrastructure, fixed-broadband infrastructure requires much larger investments. As Chapter 4 of this report shows, particularly in the last mile, broadband access is improved by extending fibre connections all the way to the home or the business. These new fixed-broadband networks provide higher speed, capacity and quality of service than mobile-broadband networks. Therefore, mobile-broadband is a complement to rather than a substitute for fixed-broadband access. This holds especially true for high-end users, such as organizations or businesses, who will require advanced fixed-broadband infrastructure in order to take full advantage of broadband.

In most developed countries, fixed networks are largely in place (except in some remote areas), and they are being upgraded with next-generation networks, which provide the necessary capacity for advanced broadband applications. In these countries, increasing use of multiple devices as well as more and more data traffic dominated by video (e.g. media content, streaming movies) and audio is expected to be observed in the coming years. Advertised broadband speeds are likely to rise, over both fibre and cable networks. Most of the increase in data traffic will come from fixed networks (and to a lesser extent traffic over mobile networks), which will result in demand for more bandwidth (Cisco, 2011).

In many developing countries, on the other hand, the roll-out of basic fixed-broadband infrastructure is still ongoing, or in the planning stage. Once the service is available

Chart 1.7: Population covered by 2G/3G services, 2011



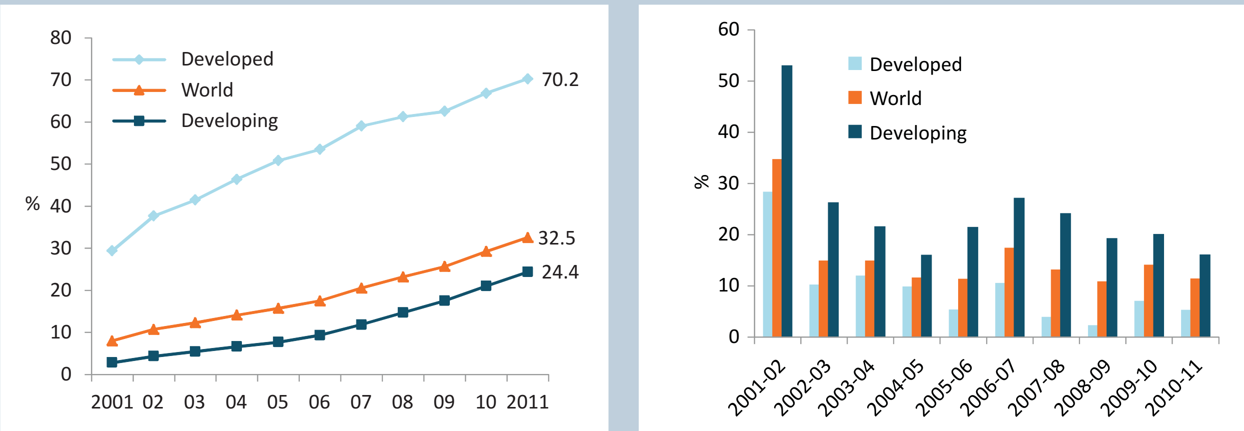
Source: ITU World Telecommunication/ICT Indicators database.
Note: * Estimates.

commercially, it is expected to fill the gap for high-speed fixed broadband in some – mainly urban – areas. Other areas will remain limited to wireless-broadband infrastructure, which currently depends on technology that offers a lower bandwidth compared to the bandwidths available with fixed technologies. Unless bandwidth is significantly expanded, data traffic will be restricted to content that can be downloaded with limited bandwidth. A promising development is the increase in WiMAX deployment in some developing countries, providing high-speed broadband services to users in locations with limited fixed (wired)-network infrastructure.

Internet uptake

On the back of the increase in broadband services worldwide, in particular wireless-broadband services in developing countries, the number of people using the Internet grew by 11 per cent over the past year (Chart 1.8). By end 2011, more than one-third of the population worldwide

Chart 1.8: Percentage of individuals using the Internet, 2001-2011, world and by level of development, penetration (left) and annual growth (right)



Source: ITU World Telecommunication/ICT Indicators database.

was online, i.e. 2.3 billion people. Internet user growth was higher in developing (16 per cent) than developed (5 per cent) countries. This reflects the large differences in penetration rates, which by end 2011 stood at 70 per cent in developed countries compared with 24 per cent in developing countries.

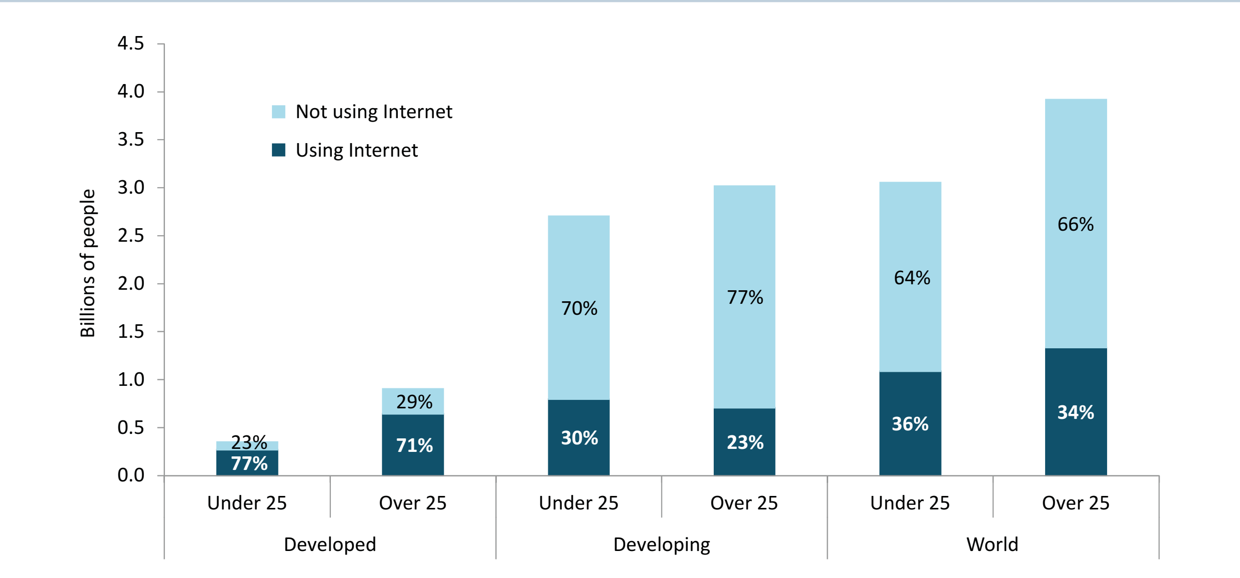
Internet user penetration rates in developing countries have tripled over the past five years, and the developing countries' share of the world's total number of Internet users has increased, from 44 per cent in 2006 to 62 per cent in 2011. Today, Internet users in China account for 23 per cent of the world's total Internet users and 37 per cent of the developing countries' Internet users.

Younger people tend to be more online than older people, in developed and developing countries alike. At end 2011, 45 per cent of the world's over 2.3 billion Internet users were below the age of 25. Of the world's population under the age of 25, 36 per cent are Internet users, whereas 34 per cent of people over the age of 25 are online. In developing countries, 30 per cent of people under the age of 25 use the Internet, compared with 23 per cent of those above the age of 25. At the same time, 70 per cent of those under 25 – a total of 1.9 billion people – in developing countries are not online yet , which constitutes a huge potential if developing countries succeed in connecting schools and increasing school enrolment rates (Chart 1.9).

More and more people have access to the Internet from home. Between 2010 and 2011, the proportion of households with Internet access grew by 14 per cent. By end 2011, out of 1.8 billion households worldwide, one-third or 600 million had Internet access. In developed countries, growth is much lower, at 6 per cent, reflecting the fact that a high proportion of households are already connected to the Internet (70.3 per cent by end 2011). Although the numbers are expected to continue growing over the next few years, they will flatten soon, as saturation is reached. Most households in developed countries will have fixed-broadband Internet access, and Internet video/IPTV will increasingly replace traditional TV broadcasting. This will increase data traffic and prompt demand for more capacity.

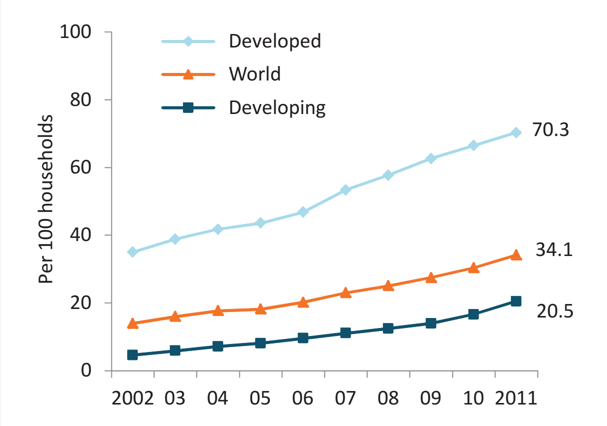
In developing countries, on the other hand, Internet access at home continues to grow at a high rate, namely 23 per cent during the past year (compared to 18 per cent growth between 2009 and 2010). By end 2011, more than 20 per

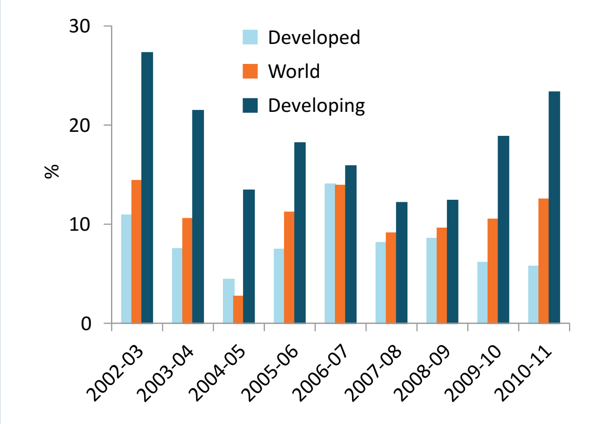
Chart 1.9: Internet usage by age in developing and developed countries, 2011*



Source: ITU World Telecommunication/ICT Indicators database.
Note: * Estimate.

Chart 1.10: Households with Internet access, 2002-2011, world and by level of development, penetration (left) and annual growth (right)





Source: ITU World Telecommunication/ICT Indicators database.

cent of households in developing countries had Internet access, as against 17 per cent a year earlier (Chart 1.10). The availability of wireless-broadband services is the main driver of this growth, bringing Internet to many homes via wireless devices. Given the larger average household size in developing countries, increased Internet access at home multiplies the number of Internet users.

International ICT development targets

The above figures illustrate the impressive overall progress that has been made in the telecommunication market and in the spread of ICT services and ICT uptake. The continuous growth observed will bring the various benefits of ICTs to more and more people in developing countries.

At the same time, while in most developed countries it is difficult to imagine day-to-day life without Internet, two-thirds of the world's population, and more than three-quarters of the population in developing countries, are not yet online, and of those that are, many do not have access to high-speed, high-quality Internet services.

While in many high-income, developed economies the majority of fixed (wired)-broadband subscriptions deliver very high speeds (of above 10 Mbit/s), many subscriptions in developing countries are limited to speeds below 2 Mbit/s. This effectively restricts the type and quality of applications and services that users can access over the Internet. It is also important to note that while mobile-broadband technology helps to increase coverage and offer mobility, the mobile networks and services currently in place usually only allow limited data access, at lower speeds, which often makes mobile-broadband subscriptions unsuitable for intensive users, such as businesses and institutions. High-speed, reliable broadband access is particularly important for the delivery of vital public services, such as those related to education, health and government. The potential and benefit of mobile-broadband services is therefore constrained when mobile broadband is used to replace, rather than complement, fixed (wired)-broadband access.

The need to bridge the digital divide and make broadband Internet access universal has been recognized within key international development goals, such as the Millennium Development Goals (MDGs) and the targets of the World Summit on the Information Society (WSIS). With the 2015 target date only three years away, ITU and its partners are actively working towards achievement of the goals and targets, and are positioning the need for universal access to broadband infrastructure at the very centre of attention of policy-makers. Thus, in October 2011, the Broadband Commission for Digital Development endorsed four concrete targets to be achieved by 2015, covering broadband policy, affordability and uptake (Box 1.1). ITU is responsible for tracking progress towards achievement

Box 1.1: Broadband Commission for Digital Development: Four ambitious but achievable targets for 2015

The Broadband Commission for Digital Development was launched in 2010 by ITU and UNESCO. It comprises global and government leaders from around the world and highest-level representatives from relevant industries, international agencies, civil society and organizations concerned with development, brought together to debate policy guidance and best practices with regard to the deployment and roll-out of broadband networks and services.

The objectives of the Broadband Commission include:

- Advocating the faster deployment of universal access to broadband networks in order to accelerate progress towards the MDGs and to avoid developing countries being excluded from the global digital economy and information revolution
- Monitoring and measuring global broadband development
- Developing policy guidance, including specific, targeted training for regulators, involving the private sector, on how to improve regulation and spectrum allocation techniques
- Using the expertise of its business-oriented commissioners to search for self-sustaining, viable business models for lower-end mass markets in developing countries.

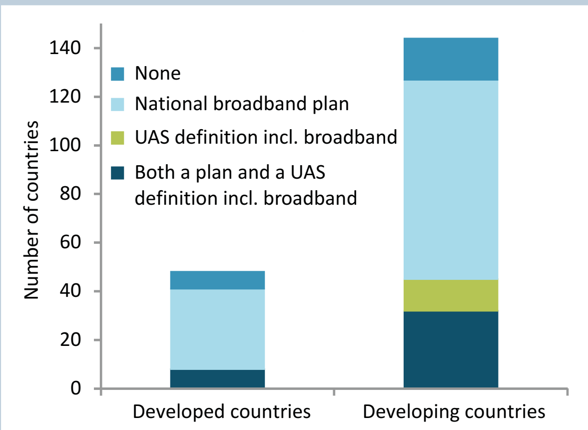
At its fourth meeting in October 2011 in Geneva, the Broadband Commission endorsed a set of four new "ambitious but achievable" targets that countries around the world should strive to meet in order to ensure their populations participate fully in tomorrow's emerging knowledge societies. The targets cover broadband policy, affordability and uptake:

Target 1: Making broadband policy universal. By 2015, all countries should have a national broadband plan or strategy or include broadband in their universal access/service (UAS) definitions.

As at 2011, out of a total of 144 developing countries, 127 had established a national broadband plan, included broadband in their UAS definitions, or both (Chart Box 1.1.1). A total of 13 developing countries had a UAS definition that included broadband, and 32 developing countries had both established a national broadband plan and included broadband in their UAS definition. Given that more and more countries are elaborating national broadband plans that recognize the importance of broadband as a core national infrastructure, the target of 100 per cent by 2015 could be achieved.

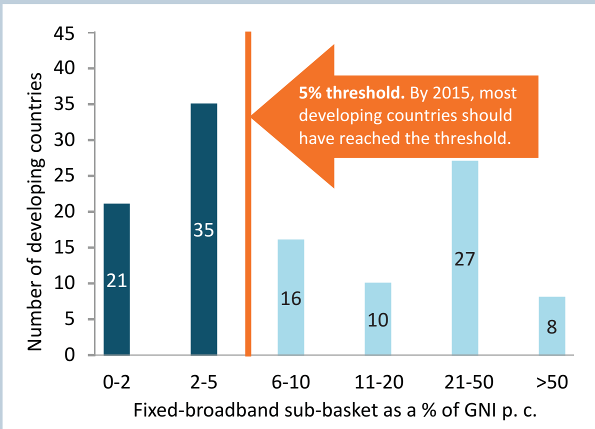
Target 2: Making broadband affordable. By 2015, entry-level broadband services should be made affordable in developing countries through adequate regulation and market forces (e.g. be priced at less than 5 per cent of average monthly GNI per capita).

Chart Box 1.1.1: National policy instruments in place to promote broadband, 2011



Source: ITU, Regulatory Knowledge Centre.

Chart Box 1.1.2: Fixed-broadband prices in developing countries, % of GNI per capita, 2011



Source: ITU.
Note: For further details on the methodology of the ICT Price Basket, see Chapter 3 of this report.

Box 1.1: Broadband Commission for Digital Development: Four ambitious but achievable targets for 2015 (continued)

The price of broadband services plays a critical role in broadband diffusion. Broadband prices are falling worldwide (see Chapter 3), in particular in developing countries, but are still too high, thus making broadband unaffordable for many people. In 2011, the price of fixed-broadband services in developing countries corresponded to 40.3 per cent of GNI per capita on average. A total of 56 developing countries had achieved the 5 per cent target (Chart Box 1.1.2). By comparison, in the large majority of developed countries, the target has already been achieved.

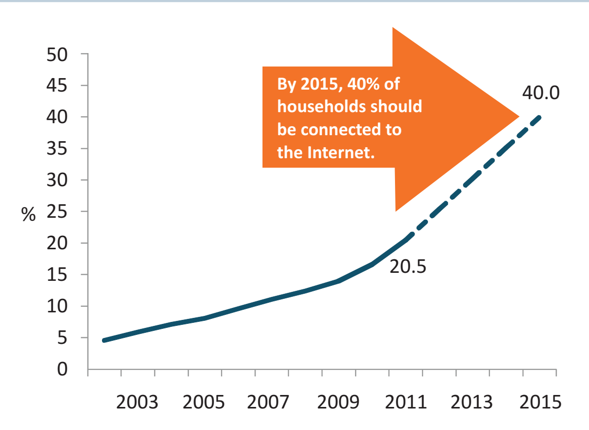
Target 3: Connecting homes to broadband. By 2015, 40 per cent of households in developing countries should have Internet access.

Having access to broadband Internet at home is the most inclusive way of bringing people into the information society. At home, all household members have a chance to go online, irrespective of whether they have jobs outside, go to school, are male or female, are children or adults, or are elderly. OECD research has shown that children with Internet access at home perform better in school. Moreover, children who are starting to use the Internet will be under parental guidance at home, and it is therefore a safer way to bring young children into the online world. In developed countries, more than 70 per cent of households had Internet by end 2011, as compared with 20 per cent in developing countries (up from 17 per cent a year previously). This number has to double to reach the target of 40 per cent by 2015 (Chart Box 1.1.3). In comparison, at the end of 2010, around 80 per cent of households worldwide have TV (developing countries 72 per cent; developed countries 98 per cent).

Target 4: Getting people online. By 2015, Internet user penetration should reach 60 per cent worldwide, 50 per cent in developing countries and 15 per cent in LDCs.

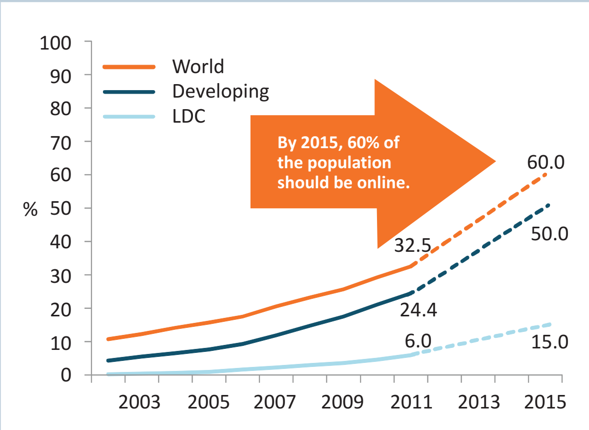
At end 2011, Internet user penetration rates stood at 33 per cent globally, 24 per cent in developing countries and 6 per cent in least developed countries (LDCs) (Chart Box 1.1.4). Growth has to accelerate substantially if the target is to be met, especially in LDCs. In view of the steep increase in mobile-broadband subscriptions, however, the target may be achievable if services and devices are offered at affordable rates; if new applications are developed that are geared to less educated or marginalized population groups; and if important barriers related to skills, literacy, content and languages are addressed.

Chart Box 1.1.3: Percentage of households with Internet access, developing countries



Source: ITU.

Chart Box 1.1.4: Percentage of individuals using the Internet



Source: ITU.

of the four Broadband Commission targets. The indicators agreed by the commission are collected by ITU on an annual basis and published in its World Telecommunication/ICT Indicators (WTI) database, the ICT Eye online portal and flagship reports such as the Measuring the Information Society (MIS) report and the Trends in Telecommunication Reform report. The Broadband Commission is planning to publish an annual report highlighting and describing

progress towards the targets in greater detail, based on ITU data.

In order to further accelerate the spread of ICTs in developing countries and to bridge the digital divide, ITU organized two Connect Summits in 2012, the Connect Arab Summit (held in Doha, Qatar, in March 2012) and the Connect Americas Summit (held in Panama City, Panama, in July 2012).[2] These regional summits bring together a large number of heads of state, ICT ministers, CEOs from the ICT industry and leaders from international and regional organizations to identify the policies and strategies that foster ICT market opportunities and growth across the regions.

The Connect Summits aim to mobilize the human, financial and technical resources required to close ICT gaps in the regions where they are held. A key outcome of the Connect Arab and Connect Americas events was a series of commitments by public and private stakeholders to invest in the ICT sector in the two regions.

The investment opportunities identified by the Connect Arab Summit focused on such key priorities as building telecommunication and information technology infrastructure, developing Arabic digital content, creating an enabling environment, empowering local people through training and human capacity building, promoting innovation in the various fields pertaining to ICT, strengthening cybersecurity and protecting Arab heritage and culture.

At the Connect Americas Summit, leaders committed to focus on five regional priorities for the region, in line with those adopted at the World Telecommunication Development Conference in Hyderabad, India, in 2010: the development of infrastructure, the adoption of national regulatory frameworks which help close existing gaps in ICT development, the establishment of effective and practical emergency communication plans, the implementation of a smooth transition from analogue to digital broadcasting, the development of Internet exchange points at the local, national and regional levels to reduce Internet access costs, and promotion of the use of ICTs as a tool for development by creating human and institutional capacities.

Overview of this publication

The main objective of this report is to identify recent global and regional trends in ICT deployment and uptake, on the basis of internationally comparable ICT statistics. A key feature of the MIS report series is the presentation of two tools for benchmarking the information society: the ICT Development Index (IDI) and the ICT Price Basket (IPB). The latest results for these two metrics will help policy-makers monitor trends, identify areas for policy action and compare their ICT developments with those in other markets. In addition, each year the report looks at specific information-society aspects and discusses them on the basis of quantitative analyses. The purpose is to provide an unbiased overview of ICT trends for as many countries as possible, especially in the developing world.

The data used in the report are primarily statistics collected by ITU, complemented by data received from the United Nations Population Division (population statistics), the UNESCO Institute for Statistics (UIS) (statistics on literacy and school enrolment), the World Bank (data on GNI per capita and PPP dollars), and UNCTAD, OECD and IMF (data on revenue and investment).

Chapter 2 features the main results of the latest IDI, comparing the year 2011 with 2010. After an introduction summarizing the main objectives and methodology of the IDI, it presents a global IDI analysis, highlighting key performers and the most dynamic countries (i.e. those with highest growth rates), especially among the developing countries. It also looks at the relationship between the IDI and GNI per capita, analyses IDI results by level of development and identifies the "least connected countries". This is followed by an analysis of the three IDI sub-indices: the access sub-index, the use sub-index and the skills sub-index. The sub-index analysis will be along the same lines as the global analysis (highlighting key performers). Finally, a regional analysis of the IDI is carried out, presenting the IDI results separately for each of the six regions,[3] and briefly describing the main findings. The entire chapter is supplemented by country examples.

Chapter 3 presents the main results of the latest ICT Price Basket (IPB). After describing the background and purpose of the IPB as well as its methodology, the chapter

goes on to present the main aggregate trends in price developments between 2008 and 2011, highlighting the major changes globally and in developed and developing countries. This is followed by an analysis of the main results of the IPB, comparing 2011 and 2010 data. It includes an analysis of each sub-basket: the fixed-telephone sub-basket, the mobile-cellular sub-basket and the fixed-broadband sub-basket. While the IPB is shown as a percentage of GNI per capita, data for each sub-basket are also given in USD and PPP dollars. Countries with the greatest decreases in prices are highlighted, especially those from the developing world. Each of the six regions is then analysed in turn, focusing particularly on mobile-cellular and fixed-broadband prices. Finally, the chapter provides a new analysis of mobile-broadband prices, based on the 2011 pilot data-collection exercise for mobile broadband carried out by ITU.

ICT and telecommunication infrastructure deployment is the foundation on which the information society is built and can flourish. Monitoring the ICT industry is therefore critical to understanding future ICT developments. Accordingly, Chapter 4 takes a closer look at recent revenue and investment trends in the ICT sector, and the telecommunication sector in particular. It first presents an analysis of the total telecommunication market in terms of revenue, before focusing specially on the mobile market. It illustrates the weight of the telecom sector in the economy, identifies recent changes in this regard, and shows the emerging weight of the mobile sector. The chapter then goes on to analyse investment trends in the sector, in respect of both total telecom investment as well as foreign direct investment. It also shows global shifts in this regard, and compares revenue and investment trends. The analysis is supplemented with concrete country examples, particularly from developing countries.

Chapter 5 presents a new approach, which consists in measuring the information society by looking at subscribed and effective telecommunication capacity, to complement traditional approaches based on subscription data. It shows that technological advances, such as the improved capacity of devices to transmit and receive data and enhanced data compression algorithms, have contributed significantly to increasing telecommunication capacity. The analysis is based on 30 telecommunication and 12 broadcasting technologies, and covers the period of digitization from 1986 to 2010. It highlights the differences in results obtained when comparing capacity with subscription numbers at the global level, as well as between developed and developing countries, and makes suggestions for policy conclusions that can be drawn from the analysis.

Endnotes

[1] PWC (2012): "according to industry estimates, 2012 will be the year when household broadband revenues, globally, finally overtake household voice revenues".

[2] Previous ITU Connect Summits were held in Minsk, Belarus, in 2009 (Connect CIS Summit) and in Kigali, Rwanda, in 2007 (Connect Africa Summit).

[3] The six regions as defined by the ITU Telecommunication Development Bureau (BDT) are: Africa, the Americas, Arab States, Asia and the Pacific, Commonwealth of Independent States, Europe.

Chapter 2. The ICT Development Index (IDI)

2.1 Introduction to the IDI[1]

The ICT Development Index (IDI) is a composite index combining 11 indicators into one benchmark measure that serves to monitor and compare developments in information and communication technology (ICT) across countries. The IDI was developed by ITU in 2008 and first presented in the 2009 edition of Measuring the Information Society (ITU, 2009a). It was established in response to ITU Member States' request to develop an ICT index and publish it regularly. This section briefly describes the main objectives, conceptual framework and methodology of the IDI.

The main objectives of the IDI are to measure:

- The *level* and *evolution over time* of ICT developments in countries and relative to other countries.
- Progress in ICT development in both *developed* and *developing countries*: the index should be global and reflect changes taking place in countries at different levels of ICT development.
- The *digital divide*, i.e. differences between countries with different levels of ICT development.
- The *development potential* of ICTs or the extent to which countries can make use of ICTs to enhance growth and development, based on available capabilities and skills.

Conceptual framework

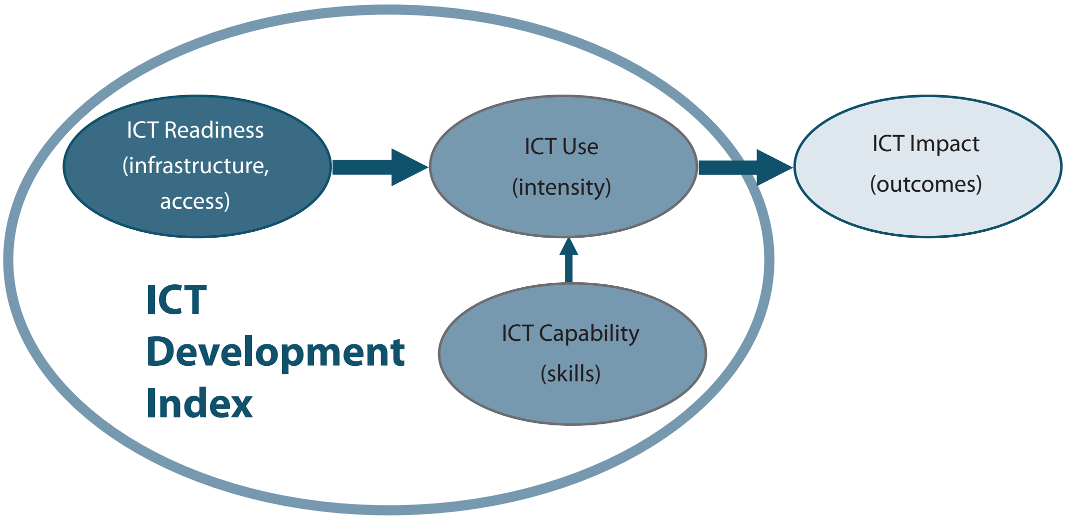
The recognition that ICTs can be a development enabler, if applied and used appropriately, is critical to countries that are moving towards information or knowledge-based societies, and is central to the IDI's conceptual framework. The ICT development process, and a country's transformation to becoming an information society, can be depicted using the following three-stage model (Figure 2.1):

- stage 1: *ICT readiness* (reflecting the level of networked infrastructure and access to ICTs)
- stage 2: *ICT intensity* (reflecting the level of use of ICTs in the society)
- stage 3: *ICT impact* (reflecting the result/outcome of efficient and effective ICT use).

Advancing through these stages depends on a combination of three factors: the availability of ICT infrastructure and access, a high level of ICT usage and the capability to use ICTs effectively. Accordingly, the first two stages listed above correspond to two major components of the IDI: *ICT access* and *ICT use*.

Reaching the final stage, and maximizing the impact of ICTs, crucially depends on the third component of the IDI: *ICT skills*. ICT (and other) skills determine the effective use that is made of ICTs, and are critical to leveraging the full potential of ICTs for socio-economic development. Economic growth and development will remain below potential if economies are not capable of exploiting new technologies and reaping

Figure 2.1: Three stages in the evolution towards an information society



Source: ITU.

their benefits. Therefore, the IDI includes a measure of the capability to use ICTs effectively.

A single indicator cannot track progress in all three components (access, usage and skills) of the ICT development process, thus requiring the construction of a composite index such as the IDI. The IDI aims to capture the evolution of the information society as it goes through its different stages of development, taking into consideration technology convergence and the emergence of new technologies.

Based on this conceptual framework, the IDI is divided into the following three sub-indices:

- *Access sub-index*: This sub-index captures ICT readiness, and includes five infrastructure and access indicators (fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, percentage of households with a computer, and percentage of households with Internet access).

- *Use sub-index*: This sub-index captures ICT intensity, and includes three ICT intensity and usage indicators (percentage of Internet users, fixed (wired)-broadband subscriptions, and active mobile-broadband subscriptions).[2]

- *Skills sub-index*: This sub-index captures ICT capability or skills as indispensable input indicators. It includes three proxy indicators (adult literacy, gross secondary enrolment and gross tertiary enrolment), and therefore is given less weight in the computation of the IDI compared with the other two sub-indices.[3]

The choice of indicators included in the sub-indices reflects the corresponding stage of transformation to the information society. Therefore, the indicators in each sub-index may change over time to reflect technological developments related to ICTs, and as more and better data become available. For example, what was considered basic infrastructure in the past – such as fixed-telephone lines – is fast becoming less relevant in the light of increasing fixed-mobile substitution. Similarly, broadband is currently considered an advanced technology, characterizing intense Internet use, and is therefore included in stage 2 (as an indicator in the use sub-index). However, in the future it may become essential and be moved to stage 1 (as an indicator in the access sub-index), while another, new technology may appear in stage 2.

Methodology

The IDI includes 11 indicators (Figure 2.2). A detailed definition of each indicator is provided in Annex 1.

Selection of the indicators was based on:

- *The relevance of a particular indicator for contributing to the main objectives and conceptual framework of the IDI*. For example, the selected indicators need to be relevant to both developed and developing countries, and should reflect – as much as possible – the framework's three components described above.[4]

- *Data availability and quality*. Data are required for a large number of countries, as the IDI is a global index. There is a relative paucity of ICT-related data, especially at the household level, in the majority of developing countries. In particular, the three indicators included in the skills sub-index should be considered as proxies until data directly relating to ICT skills become available for more countries.

- *The results of various statistical analyses*. The statistical associations between various indicators were examined, and principal components analysis (PCA) was used to examine the underlying nature of the data and to explore whether the different dimensions are statistically well-balanced.

While the basic methodology has remained the same since the IDI was first published, minor adjustments are being made each year.

Given the dynamic nature of the ICT sector and related data availability, the types of indicators to be included in the IDI and its sub-indices are under regular review in ITU, in consultation with experts. In 2011, the ITU Expert Group on Telecommunication/ICT Indicators (EGTI) opened a discussion item on the IDI on its online forum, and experts are encouraged to provide suggestions on how to improve the methodology of the IDI.[5] A major consideration is eventually to replace some of the subscription-based (supply-side) data with more data based on national household surveys (demand-side indicators). For example, in the case of mobile-cellular subscriptions, more than 80 countries included in the IDI have surpassed the 100 per cent penetration mark.[6] Much of this is due to multiple and inactive SIM card holders – which can vary significantly across countries – and therefore an indicator reflecting the actual number of individuals using a mobile phone would be preferable. It is expected that within a couple of years such an indicator will become widely available and could replace mobile-cellular subscriptions.

Another key indicator that is in the throes of major changes at the moment is wireless-broadband access. In 2010, ITU revised the definition of wireless-broadband subscriptions to reflect more accurately actual data connections to broadband networks rather than potential connections. The new indicators include satellite-broadband subscriptions, terrestrial fixed (wireless)-broadband subscriptions and active mobile-broadband subscriptions.[7] In last year's edition of the IDI, the indicator "active mobile-broadband subscriptions" replaced the previously used indicator "mobile-cellular subscriptions with access to data communications at broadband speeds", which measured the potential of mobile-cellular subscriptions to access, for example, 3G networks. In the future, once more data become available, it is foreseen to use an indicator combining all wireless-broadband subscriptions. This is becoming increasingly important insofar as a number of countries are deploying fixed (wireless)-broadband technologies, such as WiMAX, which are currently not reflected in the IDI.

The IDI was computed using the same methodology as in the past, applying the following steps (Figure 2.2 and Annex 1):

- *Preparation of the complete data set*. This step includes filling in missing values using various statistical techniques.

- *Normalization of data*. This is necessary in order to transform the values of the IDI indicators into the same unit of measurement. The chosen normalization method was the distance to a reference measure (or goalpost). The reference values were either 100 or obtained through a statistical procedure.

- *Rescaling of data*. The data were rescaled on a scale from 0 to 10 in order to compare the values of the indicators and the sub-indices.

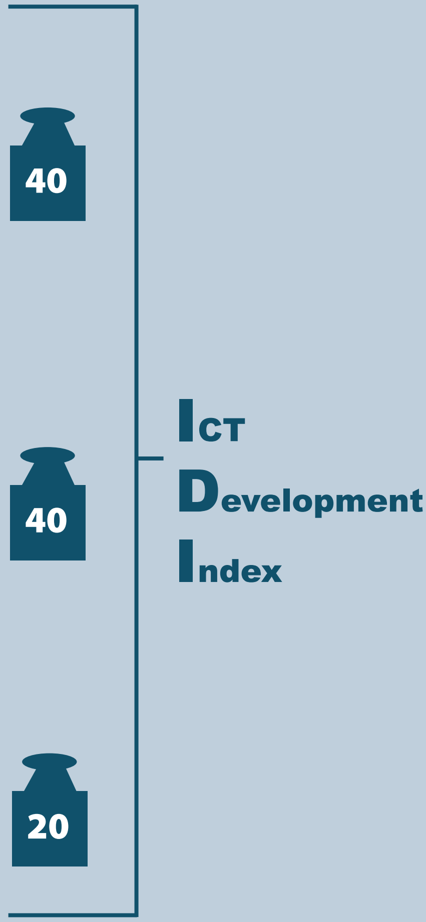
- *Weighting of indicators and sub-indices*. The indicator weights were chosen based on the PCA results.

Figure 2.2: ICT Development Index: indicators and weights

ICT access	Ref. value	(%)
1. Fixed-telephone lines per 100 inhabitants	60	20
2. Mobile-cellular telephone subscriptions per 100 inhabitants	180	20
3. International Internet bandwidth (bit/s) per Internet user	408'813*	20
4. Percentage of households with a computer	100	20
5. Percentage of households with Internet access	100	20

ICT use	Ref. value	(%)
6. Percentage of individuals using the Internet	100	33
7. Fixed (wired)-broadband Internet subscriptions per 100 inhab.	60	33
8. Active mobile-broadband subscriptions per 100 inhab.	100	33

ICT skills	Ref. value	(%)
9. Adult literacy rate	100	33
10. Secondary gross enrolment ratio	100	33
11. Tertiary gross enrolment ratio	100	33



Source: ITU.
Note: * This corresponds to a log value of 5.61, which was used in the normalization step.

The access and use sub-indices were given equal weight (40 per cent each). The skills sub-index was given less weight (20 per cent), since it is based on proxy indicators.

This chapter presents the IDI results for 2011 in comparison with 2010. It should be noted that the 2010 IDI values have changed from those published in the previous edition of this report as a result of:

- *Country data revisions*. As more accurate data become available, countries provide ITU with revised statistics for previous years, which have been taken into consideration. This also allows ITU to identify inconsistencies and revise previous estimates. For this edition, in particular, many countries have updated the 2010 values for the indicator "active mobile-broadband subscriptions".[8]
- *Differences among countries included in the IDI*. Since the IDI is a relative measure, the calculation of the IDI value depends on the values of the other countries included. In each new edition, some countries are excluded and others added based on data availability. Overall, this version of the IDI includes 155 countries/economies as compared with 152 in last year's edition.

The remainder of the chapter is structured as follows. Section 2.2 presents the IDI results at the global level. It highlights some of the top performers, as well as the most dynamic

countries in terms of changes in IDI value and rank. Section 2.3 analyses the digital divide. It looks at the relationship between a country's IDI score and its income level, presents IDI results by level of development (developed/developing countries) and by groups of countries with different IDI levels.

Section 2.4 analyses the three sub-indices (access, use and skills), providing additional insights into areas of high/low ICT growth, in order to identify areas requiring further attention from policy-makers and private stakeholders.

Finally, section 2.5 presents a regional analysis of the IDI. It shows IDI results for six regions (Africa, the Americas, Arab States, Asia and the Pacific, Commonwealth of Independent States (CIS) and Europe), as well as a comparative analysis of the six regions.

2.2 Global IDI analysis

Overall results

The computed values of the IDI and its sub-indices are presented on a scale from 0 to 10, thus making it possible to compare the performance of the 155 countries included in this year's IDI.[9] Between 2010 and 2011, almost all countries improved their IDI values, which testifies to the continuous growth of ICT uptake worldwide. On average, the IDI increased by 0.21 points (Table 2.1). Growth was stronger in the use sub-index (0.31 points) in comparison with the access sub-index (0.21 points). This reflects the fact that, overall, countries have already reached a higher level of performance on the access sub-index, whereas the use sub-index is at a much lower level, and many countries are still expanding in terms of ICT use. The skills sub-index did not show much change over the past year (0.01 points), since literacy and school enrolment indicators usually do not evolve to any great extent within such a short time-frame.

There are huge differences among countries, however, with IDI 2011 values ranging from 8.56 (highest value) to 0.88 (lowest value). As observed in previous years, the range has increased slightly between 2010 and 2011, indicating a widening of the gap between the country at the top and the country at the bottom of the index. This is the case for both the access and use sub-indices. The latter displays the highest coefficient of variation, indicating that it is in ICT usage that differences among countries are most marked. Some countries continue to record extremely low values in the use sub-index (close to 0). In these countries, mobile-broadband services are not yet commercially available and Internet usage is almost non-existent. The above results reflect the three stages of the conceptual framework upon which the IDI has been built, whereby countries move from stage 1 (ICT access) to stage 2 (ICT usage) as their information societies evolve. The low levels of the IDI use sub-index in some countries show that they are still at stage 1 and have not yet reached stage 2. A closer examination of the differences among countries in terms of their ICT developments, and the digital divide, will be presented in section 2.3.

Table 2.1: IDI changes, 2010-2011

	IDI 2010					IDI 2011					Change in average value 2010-2011
	Average value*	Min.-Max.	Range	SD	CV	Average value*	Min.-Max.	Range	SD	CV	
IDI	3.94	0.85-8.45	7.60	2.08	52.60	4.15	0.88-8.56	7.68	2.13	51.31	0.21
Access sub-index	4.45	0.85-9.09	8.24	2.28	51.20	4.66	0.85-9.21	8.36	2.29	49.09	0.21
Use sub-index	2.16	0.01-8.04	8.03	2.09	96.71	2.47	0.04-8.17	8.13	2.21	89.33	0.31
Skills sub-index	6.50	1.45-9.86	8.41	2.13	32.76	6.51	1.45-9.86	8.41	2.13	32.69	0.01

Source: ITU.
Note: * Simple averages. SD = Standard Deviation, CV = Coefficient of Variations.

Selected top IDI countries

Table 2.2 shows IDI values and country rankings for 2011 and 2010. The large majority of countries in the top ten of the IDI 2011 are from Europe. They include four Nordic countries (Sweden, Denmark, Iceland and Finland), the Netherlands, Luxembourg, the United Kingdom and Switzerland. From the Asia and the Pacific region, the Republic of Korea and Japan are among the top ten. The Republic of Korea tops the IDI, followed by Sweden, for the second consecutive year. While the Republic of Korea continues to stand out with an IDI value of 8.56, the four Nordic countries also achieved IDI values above eight. Remarkably, the top five countries have not changed position between 2010 and 2011, and are thus maintaining the highest ICT levels in the world.

Looking at the top 30, the vast majority (20 countries) are from Europe, but high-income economies[10] from the Asia and the Pacific region (such as Hong Kong (China), Singapore, New Zealand and Australia) and the Americas (United States and Canada) are also to be found there. Qatar is the only country from the Arab States region at the top of the index. Like all other countries in the top 30, Qatar is a high-income country, which underlines the strong link between income and IDI levels.

The following section highlights selected top performing countries.

The **Republic of Korea** tops the IDI in 2011, as it did in 2010. The country ranks first in the use and skills sub-indices, and is the only country that exceeds the eight-point mark in the use sub-index. Both mobile-broadband and fixed (wired)-broadband penetration rates are very high, and 84 per cent of the population is online. The Republic of Korea excels on all three indicators used to calculate the skills sub-index, underlining the importance of education and literacy in bringing people online. Finally, it has the highest percentage of households with Internet access worldwide (97 per cent), with virtually all households connected to the Internet.[11] The country has made ICT development a policy priority and integrated its use in many aspects of society. The Korea Communications Commission continuously works towards transforming the country into a "smart powerhouse" by effectively regulating a highly dynamic and competitive telecommunication market and pushing forward innovations and improvements, such as the deployment of LTE in 2011 (Korea Communications Commission, 2012). The country's excellent results in the IDI and other ICT-related rankings, such as the United Nations E-Government Survey, as well as the importance of the ICT sector for the country's economy, single it out as a model for ICT-driven development.

Sweden comes in second place, also unchanged from 2010. The country ranks second in the use sub-index, just after the Republic of Korea. No fewer than 91 per cent of the population is using the Internet, and the country's broadband infrastructure is highly developed. Mobile broadband plays a very important role in the country, and Sweden has by far the highest mobile-broadband penetration rate in Europe, at 92 per cent, ahead of Finland and Denmark. A user survey[13] conducted by the Swedish Post and Telecom Agency (PTS) finds that 17 per cent of households connect to the Internet exclusively through mobile broadband using USB modems or data cards. Swedes use many different and complementary devices to access the web: 30 per cent of respondents use their handsets and 5 per cent tablet computers, in addition to the device they generally use at home (such as a computer or laptop) (Swedish Post and Telecom Agency, 2011a). Over 90 per cent of Swedish households have a computer and are connected to the Internet, and the country enjoys ample international Internet bandwidth per Internet user, contributing to its equally high rank in the access sub-index. This is the result of a successful broadband strategy in place since the 1990s, which has made safe and affordable Internet access a policy priority. Looking to the future, PTS wants to ensure that, by 2020, 90 per cent of Swedish households and businesses have access to broadband services with a minimum speed of 100 Mbit/s (Swedish Post and Telecom Agency, 2011b).

Denmark ranks third in the IDI 2011, also the same as in 2010. While it continues to perform well in all three sub-indices of the IDI, it ranks highest in the use-sub index, where it improved its value from 7.17 in 2010 to 7.79 in 2011. Mobile-broadband penetration shows the most significant increase, and stands at 80 per cent in 2011. A total of 90 per cent of Danes use the Internet, one of the highest rates in the world. While continuing to upgrade and expand the country's ICT infrastructure, the Danish government is focusing on the

Table 2.2: ICT Development Index (IDI), 2010 and 2011

Economy	Rank 2011	IDI 2011	Rank 2010	IDI 2010
Korea (Rep.)	1	8.56	1	8.45
Sweden	2	8.34	2	8.21
Denmark	3	8.29	3	8.01
Iceland	4	8.17	4	7.96
Finland	5	8.04	5	7.89
Netherlands	6	7.82	7	7.60
Luxembourg	7	7.76	6	7.64
Japan	8	7.76	8	7.57
United Kingdom	9	7.75	14	7.35
Switzerland	10	7.68	9	7.48
Hong Kong, China	11	7.68	12	7.39
Singapore	12	7.66	10	7.47
Norway	13	7.52	11	7.39
Macao, China	14	7.51	13	7.38
United States	15	7.48	16	7.11
Germany	16	7.39	15	7.18
New Zealand	17	7.34	18	7.03
France	18	7.30	17	7.08
Austria	19	7.10	22	6.74
Ireland	20	7.09	19	6.99
Australia	21	7.05	21	6.75
Canada	22	7.04	20	6.87
Belgium	23	6.89	23	6.60
Estonia	24	6.81	26	6.36
Slovenia	25	6.70	24	6.54
Malta	26	6.69	28	6.30
Israel	27	6.62	25	6.41
Spain	28	6.62	27	6.31
Italy	29	6.28	29	6.13
Qatar	30	6.24	31	5.94
Poland	31	6.19	30	6.09
Czech Republic	32	6.17	33	5.89
Greece	33	6.14	35	5.88
Barbados	34	6.07	32	5.91
Lithuania	35	6.06	34	5.88
Latvia	36	6.06	37	5.80
Portugal	37	6.05	36	5.86
Russian Federation	38	6.00	40	5.61
Slovakia	39	5.86	39	5.63
Bahrain	40	5.85	45	5.19
Hungary	41	5.77	42	5.53
Croatia	42	5.75	41	5.54
Antigua & Barbuda	43	5.74	44	5.35
Cyprus	44	5.73	38	5.64
United Arab Emirates	45	5.64	43	5.41
Belarus	46	5.57	46	5.08
Saudi Arabia	47	5.43	53	4.81
Serbia	48	5.40	47	5.04
Kazakhstan	49	5.27	56	4.65
Uruguay	50	5.24	49	4.89
Bulgaria	51	5.20	51	4.87
Romania	52	5.13	50	4.89
Oman	53	5.10	54	4.75
TFYR Macedonia	54	5.05	48	4.90
Chile	55	5.01	58	4.63
Argentina	56	5.00	55	4.72
Brunei Darussalam	57	4.95	52	4.85
Malaysia	58	4.82	57	4.63
St. Vincent and the G.	59	4.74	59	4.58
Brazil	60	4.72	67	4.17
Trinidad & Tobago	61	4.57	60	4.42
Moldova	62	4.55	62	4.24
Bosnia and Herzegovina	63	4.53	64	4.21
Saint Lucia	64	4.49	61	4.36
Lebanon	65	4.48	68	4.11
Panama	66	4.41	63	4.21
Ukraine	67	4.40	65	4.20
Azerbaijan	68	4.39	73	3.83
Turkey	69	4.38	66	4.17
Seychelles	70	4.37	69	4.00
Costa Rica	71	4.37	71	3.94
Maldives	72	4.30	72	3.92
Georgia	73	4.20	75	3.75
Mauritius	74	4.18	70	3.95
Jordan	75	3.95	77	3.61
Colombia	76	3.93	76	3.73
Venezuela	77	3.92	74	3.78
China	78	3.88	79	3.58
Mexico	79	3.79	78	3.60
Albania	80	3.78	80	3.48
Viet Nam	81	3.68	86	3.41
Ecuador	82	3.68	85	3.41
Egypt	83	3.66	81	3.44
Mongolia	84	3.63	87	3.36
Tunisia	85	3.58	83	3.42
Peru	86	3.57	82	3.43
Iran (I.R.)	87	3.53	88	3.35
Fiji	88	3.50	93	3.08
Jamaica	89	3.49	84	3.42
Morocco	90	3.46	92	3.19
South Africa	91	3.42	90	3.20
Thailand	92	3.41	89	3.29
Dominican Rep.	93	3.34	91	3.19
Philippines	94	3.19	94	3.04
Indonesia	95	3.19	97	3.01
Syria	96	3.15	96	3.01
Paraguay	97	3.14	99	2.94
Bolivia	98	3.13	100	2.93
Guyana	99	3.12	95	3.02
Tonga	100	3.12	98	2.94
Cape Verde	101	3.08	101	2.90
Uzbekistan	102	3.05	104	2.77
El Salvador	103	2.99	102	2.89
Algeria	104	2.98	103	2.86
Sri Lanka	105	2.88	105	2.74
Cuba	106	2.77	107	2.66
Honduras	107	2.72	106	2.71
Botswana	108	2.67	108	2.50
Namibia	109	2.51	112	2.27
Turkmenistan	110	2.49	109	2.44
Gabon	111	2.47	110	2.40
Tuvalu	112	2.46	113	2.23
Nicaragua	113	2.44	111	2.31
Kenya	114	2.32	114	2.07
Zimbabwe	115	2.24	118	1.89
Swaziland	116	2.24	115	2.06
Ghana	117	2.23	121	1.81
Bhutan	118	2.13	117	1.92
India	119	2.10	116	1.98
Lao P.D.R.	120	1.99	120	1.84
Cambodia	121	1.96	119	1.88
Nigeria	122	1.93	124	1.75
Solomon Islands	123	1.85	127	1.67
Senegal	124	1.85	122	1.76
Gambia	125	1.84	123	1.75
Yemen	126	1.76	126	1.70
Pakistan	127	1.75	125	1.71
Djibouti	128	1.74	128	1.65
Côte d'Ivoire	129	1.69	131	1.62
Comoros	130	1.68	130	1.64
Myanmar	131	1.67	129	1.65
Uganda	132	1.67	136	1.53
Rwanda	133	1.66	140	1.50
Togo	134	1.65	132	1.59
Zambia	135	1.65	137	1.53
Mauritania	136	1.64	138	1.53
Nepal	137	1.63	134	1.55
Cameroon	138	1.60	135	1.54
Tanzania	139	1.60	139	1.52
Congo (Rep. of the)	140	1.60	133	1.55
Benin	141	1.55	141	1.49
Papua New Guinea	142	1.44	144	1.36
Madagascar	143	1.44	142	1.41
Malawi	144	1.42	143	1.37
Mali	145	1.38	147	1.24
Congo (Dem. Rep.)	146	1.30	149	1.18
Mozambique	147	1.28	145	1.26
Guinea	148	1.28	146	1.25
Liberia	149	1.26	148	1.20
Ethiopia	150	1.15	150	1.09
Burkina Faso	151	1.14	152	1.06
Eritrea	152	1.09	151	1.08
Central African Rep.	153	0.97	153	0.96
Chad	154	0.94	155	0.85
Niger	155	0.88	154	0.88

Source: ITU.

promotion and development of 'valuable digital content' as a driver for Internet use. An example is the citizen's portal borger.dk[14] which provides access to a number of public services, from e-government to healthcare. The Open Data Innovation Strategy is another example of an initiative to provide meaningful content – in this case public data – to users. Available public data can then be used by citizens and businesses to further develop products and services (Danish Government, 2011).

The **Netherlands** sits in sixth place in the IDI, and ranks high in all three sub-indices. The country has one of the highest percentages of households with a computer, and also of households with Internet access, in the world. It is the frontrunner in terms of household Internet connectivity in Europe. More Dutch households are connected to the Internet (94 per cent) than have a computer (93 per cent). This indicates that some households access the Internet through devices other than a computer, such as smartphones or tablets, which also tallies with the high number of mobile-broadband subscriptions. Indeed, at 49 per cent, the country has a very high mobile-broadband penetration rate, exceeding that of neighbouring Belgium and Germany. According to telecommunication regulator OPTA, mobile-broadband subscription numbers and data usage 'skyrocketed' in 2011, and more than half of mobile-cellular subscriptions now include data plans.[15]

The **United Kingdom** moved up five places to ninth place in the IDI 2011. This is mostly the result of an increase in the use sub-index value, from 5.75 to 6.62. While Internet usage and fixed (wired)-broadband penetration, which are already very high, continued to grow steadily from one year to the other, there was a sharp increase in mobile-broadband penetration between 2010 and 2011. By end 2011, mobile-broadband penetration stood at 62 per cent, as against 43 per cent a year earlier (see Box 2.7). Like in the Netherlands, the number of households with Internet access exceeds the number of households with a computer.

Switzerland ranks tenth in the IDI 2011 rankings, having increased its IDI from 7.48 to 7.68. The country fares particularly well on the access sub-index, where it comes in second place. In 2011, 90 per cent of Swiss households had a computer, and just under 89 per cent had access to the Internet. Furthermore, Switzerland is among the countries with the highest fixed-telephone penetration worldwide, at 61 per cent. While Switzerland stands out on the access sub-index, the largest value changes were in the use sub-index, confirming that a well-developed infrastructure is an important foundation for increased ICT use. The country's fixed (wired)-broadband penetration rate, at 39 per cent, is the highest in the world. Mobile-broadband penetration lags behind, but is steadily increasing, from 31 per cent in 2010 to 36 per cent in 2011.

The **United States** moved up one rank to 15th place in the IDI 2011. In past editions of this report, the relatively low mobile-cellular penetration rate and percentage of households connected to the Internet have been pointed out (ITU 2010, 2011b). In 2011, however, strong growth on both these indicators has resulted in an increase in its access sub-index, and its higher overall ranking. Mobile-cellular penetration now exceeds 100 per cent, having grown from just under 90 per cent in 2010 to around 106 per cent in 2011. Household Internet access also increased, from 72 per cent in 2010 to 76 per cent in 2011, showing that the National Broadband Plan is starting to bear fruit. The National Broadband Plan was passed by Congress in 2009, acknowledging that the United States was lagging behind, and affirming the need to extend broadband access which is "essential to opportunity and citizenship" (Federal Communications Commission, 2010). The use sub-index value improved as well, mainly thanks to continuing high growth in mobile-broadband uptake. Finally, the United States ranks third in the skills sub-index, with very high performance on all three indicators.

New Zealand increased its overall ranking by one place, to 17th. It continues to perform very well in connecting households to the Internet and expanding the fixed-telephone network. While growth in mobile voice usage is slowing down, mobile data usage has almost doubled from 2009/10 to 2010/11 (Commerce Commission, 2012). This is reflected in the strong increase in mobile-broadband penetration, from 40 per cent in 2010 to 53 per cent in 2011, resulting in the country's improvement in the use sub-index. While slightly improving its ranking in the use sub-index, New Zealand fell by one place in the access sub-index: mobile-cellular penetration has grown little and the mobile-cellular market is nearing saturation levels.

France ranks 18th in the IDI 2011, with the biggest changes taking place in the use-sub index. The country improved its IDI value from 7.08 in 2010 to 7.30 in 2011. Both fixed- and mobile-broadband penetration rates increased significantly, and almost 80 per cent of the population is online. The increase in the number of mobile-broadband subscriptions can be linked to the entry of a new low-cost mobile operator, which had a 'disruptive' effect on the French mobile market (see Chapter 3, Box 3.1). Fixed (wired)-broadband penetration is among the highest in the world, and around 3 per cent of fixed (wired)-broadband subscriptions have advertised download speeds of 50 Mbit/s or higher (ARCEP, 2012a). High speed is a prerequisite for IPTV usage, and France stands out with a particularly high number of IPTV subscriptions. A study by ARCEP shows that over 50 per cent of broadband subscriptions include IPTV subscriptions (ARCEP, 2012b).[16]

Most dynamic countries

As shown in the previous section, there was relatively little movement among the top 30 countries in the IDI, which improved their IDI values at a similar pace overall between 2010 and 2011.[17] The most dynamic countries (i.e. those with above-average changes in IDI value or ranking) can be found in the upper and medium segments of the index. While top IDI performers are largely high-income, developed countries from Europe and the Asia and the Pacific region, the most dynamic performers are primarily from the developing world, and include countries from all regions. This reflects not only the fact that these countries have lower initial IDI levels, but also the recent introduction of wireless-broadband services, which are experiencing rapid uptake by users in developing countries.

This section presents the most dynamic countries in terms of changes in IDI ranking as well as absolute and relative IDI values (see Table 2.3). By taking a closer look at key indicator changes, one can point to best practices and main achievements that have led to improvements in the IDI. The spider charts (Figure 2.3) illustrate normalized values, and changes between 2010 and 2011, for each of the 11 indicators included in the IDI.

Azerbaijan moved up five places to 68th in the IDI 2011, with a 0.57 point increase in its IDI, well above the 0.21 average global change. The country continues to progress, in particular in the use sub-index, where it increased its IDI score by one point, to 2.98. Both fixed (wired)-broadband and mobile-broadband penetration show high growth rates, and the number of Internet users in the country continues to increase rapidly.

Bahrain, ranked 40th in the IDI in 2011, is the country which registered the highest increase in absolute IDI value.

Table 2.3: Most dynamic countries (top ten) – changes between IDI 2010 and 2011

Change in IDI ranking			Change in IDI value (absolute)			Change in IDI value (%)		
IDI rank 2011	Country	IDI rank change	IDI rank 2011	Country	IDI value change	IDI rank 2011	Country	IDI % change
49	Kazakhstan	7	40	Bahrain	0.66	117	Ghana	23
60	Brazil	7	47	Saudi Arabia	0.62	115	Zimbabwe	19
133	Rwanda	7	49	Kazakhstan	0.61	68	Azerbaijan	15
47	Saudi Arabia	6	68	Azerbaijan	0.57	88	Fiji	14
40	Bahrain	5	60	Brazil	0.54	49	Kazakhstan	13
68	Azerbaijan	5	46	Belarus	0.54	60	Brazil	13
88	Fiji	5	24	Estonia	0.49	47	Saudi Arabia	13
9	United Kingdom	5	73	Georgia	0.45	40	Bahrain	13
81	Viet Nam	5	71	Costa Rica	0.45	114	Kenya	12
117	Ghana	4	117	Ghana	0.43	73	Georgia	12

Source: ITU.

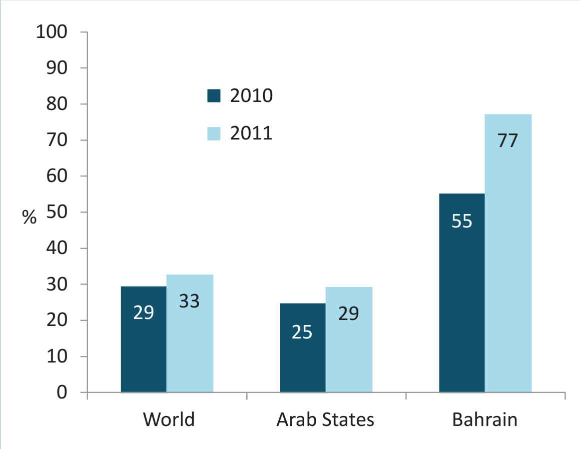
Box 2.1: Online services drive Internet usage in Bahrain

Bahrain is among the most dynamic countries in the IDI 2011, with an increase in absolute IDI value of 0.66, which is three times the average change of 0.21. The country climbed five places in the IDI rankings and now sits in 40th position, making Bahrain the second highest ranked Arab country, after Qatar.

Bahrain records very high scores in the access sub-index. Most impressive are the country's household connectivity numbers: 77 per cent of households are connected to the Internet, and 90 per cent have a computer. These numbers are comparable with or even exceed ICT household access data for the top performing countries in the IDI 2011 (see Chart Box 2.1.1).

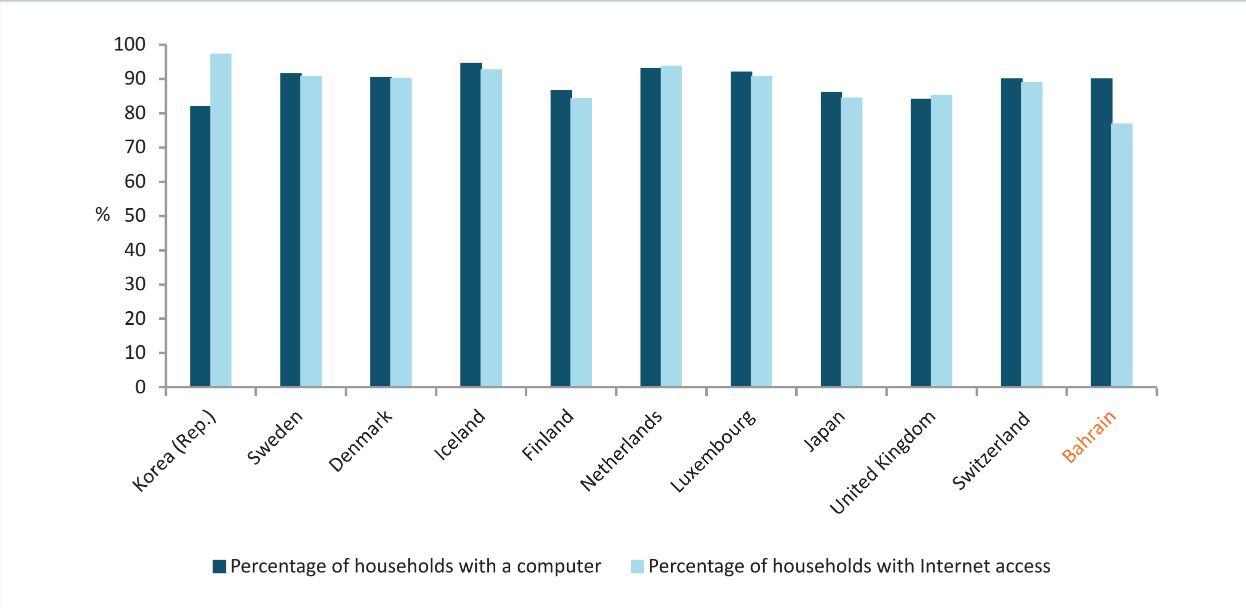
The most significant growth occurred in the use sub-index, which, in line with the three-stage model on which the IDI is based, is beginning to reap the benefits of progress made in the access sub-index. Bahrain's use sub-index increased from 2.25 in 2010 to 3.65 in 2011, which is impressive in comparison with an average change of 0.31, and represents the biggest progression of all countries in this sub-index. Massive improvements were made in all the indicators used to measure the use sub-index. The number of Internet users in Bahrain climbed to 77 per cent (2011), up from 55 per cent (2010), which is significantly higher than the regional and world averages (see Chart Box 2.1.2). Fixed (wired)-broadband penetration more than doubled, and mobile-broadband penetration almost tripled from 2010 to 2011. There are more fixed (wired)-broadband than mobile-broadband subscriptions in Bahrain and more fixed (wired)-broadband subscriptions per 100 inhabitants than in any other country in the Arab region. In addition, there are a significant number of WiMAX subscriptions[18] in the country (109 000 compared with 183 000

Chart Box 2.1.2: Percentage of individuals using the Internet, Bahrain in comparison with regional and world average, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

Chart Box 2.1.1: Percentage of households with computers and households with Internet access, Bahrain in comparison with top ten IDI economies, 2011



Source: ITU World Telecommunication/ICT Indicators database.

Box 2.1: Online services drive Internet usage in Bahrain (continued)

fixed (wired)-broadband subscriptions). Looking at the high access sub-index value, further increases in ICT usage may be expected in the country.

The Bahraini government has made extensive use of ICTs to deliver services to the country's around 1 million inhabitants and involve them in decision-making. Bahrain ranks way above the global average on the UN e-government and e-participation index, although its absolute value declined in the last year. Furthermore, Bahrain is the subregional[19] leader on the online service index (UNPAN, 2012). In its e-government strategy, Bahrain puts an emphasis on providing key services online. Today, more than 200 services are offered online, including services for residents to pay utility bills and traffic fines or for visitors to apply for tourist visas online (Kingdom of Bahrain, 2012). Many of these services, such as driving licence renewals or information about student exam results, are available as mobile-phone applications. [20]

It moved up five places, with an IDI value change of 0.66, more than three times the average global IDI change. While the country's ranking in both the access and use sub-indices improved, it is in the use sub-index that the progression is most evident, with fixed (wired)-broadband and mobile-broadband penetration more than doubling between 2010 and 2011. It is noteworthy that in Bahrain, fixed (wired)-broadband penetration, at 14 per cent, is higher than mobile-broadband penetration, which stands at 10 per cent. Bahrain's fixed (wired)-broadband penetration rate is by far the highest in the Arab region. Furthermore, 77 per cent of the population is using the Internet, a remarkable increase from 55 per cent in 2010 (see Box 2.1).

Belarus increased its IDI by 0.49 from 2010 to 2011, rising to 46th place in the IDI 2011 rankings. Growth rates are highest on the use sub-index indicators, although the access sub-index also shows improvements. In particular, the country's relatively high fixed (wired)-broadband penetration rate is worth highlighting. With a fixed (wired)-broadband penetration of 22 per cent, Belarus is far ahead of other CIS countries. Mobile-broadband penetration continues to grow, too, and the Ministry of Communications plans to expand broadband further in cities and rural areas.[20]

Brazil moved up seven places in the IDI between 2010 and 2011, to 60th, with an increase in IDI of 0.54. Major progress has been made in both the access and use sub-indices. The indicators of households with a computer and with Internet access increased by around ten percentage points each from 2010 to 2011. Mobile-cellular subscriptions continue to grow. The rise in mobile-broadband uptake is clearly outstanding: penetration doubled between 2010 and 2011, and now stands at 21 per cent, the highest in Latin America (see Box 2.2).[22]

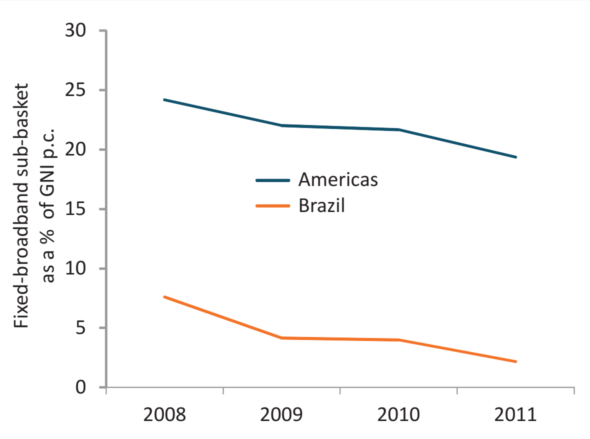
Costa Rica ranks 71st in the IDI 2011, with an increase of 0.43 in its IDI, one of the largest absolute increases and more than twice the global average change. The access sub-index grew most, mainly thanks to a steep increase in the percentage of households with Internet access. Most remarkable is the increase in the country's mobile-cellular penetration, from 65 per cent in 2010 to 92 per cent in 2011. For a long time, Costa Rica had been lagging behind other Latin American countries in terms of mobile-cellular uptake, but it has now caught up. During the past year, the country experienced major alterations in its telecommunication landscape: in the run-up to the liberalization of the telecommunication market in late 2011, incumbent ICE introduced prepaid mobile-cellular offers in 2010[31] and two new mobile operators[32] started business in November 2011. These developments could herald future increases in the index. For the time being, mobile-broadband penetration remains minimal, at around 2 per cent, but new entrants are expected to accelerate 3G roll-out.

One of the few developed countries among the most dynamic IDI countries is **Estonia**, which increased its IDI by 0.45 points and now sits in 24th place in the IDI 2011 rankings. Both the access and use sub-indices progressed, with the most dynamic change occurring in the latter. Like in many other economies, it is primarily a strong increase in mobile-broadband subscriptions that is responsible for the impressive growth in the use sub-index. Mobile-broadband penetration went up from 24 per cent in 2010 to 42 per cent in 2011, which is the highest of all Baltic countries. Estonia has long been at the forefront of information society developments, offering e-services to its citizens in many areas, including e-voting, e-health and e-taxation.[33]

Box 2.2: Broadband on the advance in Brazil

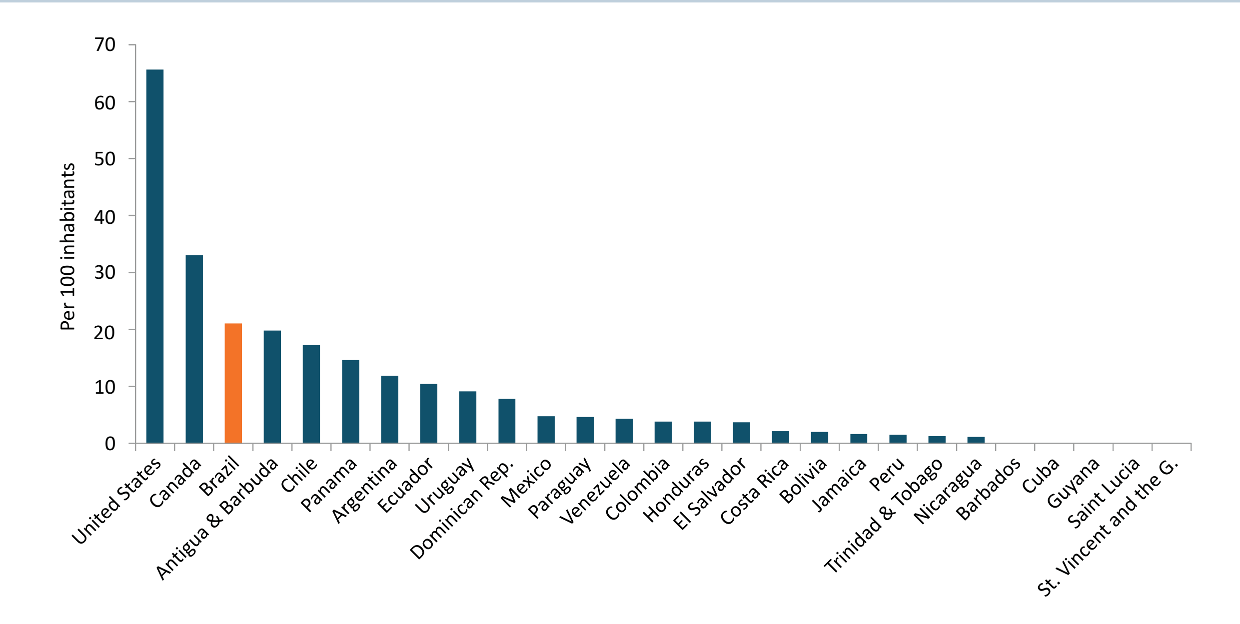
Over the past year, Brazil significantly improved its IDI, making it one of the most dynamic countries. Indeed, the country's IDI climbed by 0.54, to an overall value of 4.72. Apart from fixed telephony, all indicators used to calculate the access sub-index increased significantly. Mobile-cellular penetration showed impressive gains, and all but one Brazilian city[23] are now covered by a mobile-cellular network.[24] The percentage of households with a computer and with Internet access increased by more than 10 percentage points, to 45 and 38 per cent, respectively. In terms of household Internet connectivity, Brazil is now catching up with other Latin American countries such as Chile and Uruguay. The growth in household Internet access is a first result of Brazil's national broadband plan – *Programa Nacional de Banda Larga* (PNBL) – which has been implemented with effect from May 2010. The goal of the plan is to bring fast (at least 1 Mbit/s) and affordable broadband access to 40 million Brazilian households by 2014 (CGPID, 2010). Rural areas are targeted in particular, in order to deliver government and health services as well as e-education. Agreements have been concluded with a number of Brazilian operators to extend broadband access to communities and cap monthly subscription prices at USD 30 to 35 for connections offering speeds of 1 Mbit/s.[25] As shown in Chart Box 2.2.1, fixed (wired)-broadband prices continue to fall, and the price change in Brazil from 2010 to 2011 constitutes one of the highest relative changes (-46 per cent) in the IPB fixed-broadband sub-basket (see Chatper 3).[26] Broadband coverage is increasing steadily, and 221 localities were added in January 2012, bringing the total number of localities covered by the PNBL to 692 (out of a total of about 5 500 localities).[27]

Chart Box 2.2.1: Fixed-broadband sub-basket, the Americas compared with Brazil, 2008-2011



Source: ITU.

Chart Box 2.2.2: Active mobile-broadband subscriptions per 100 inhabitants, the Americas, 2011



Source: ITU World Telecommunication/ICT Indicators database.

Box 2.2: Broadband on the advance in Brazil (continued)

In the IDI use sub-index, improvements were made in the number of Internet users, which stands at 45 per cent in 2011, and in mobile-broadband penetration. The latter almost doubled, from 11 per cent in 2010 to 21 per cent in 2011, which is the highest penetration in Latin America, and the third highest in the Americas region, after the United States and Canada (see Chart Box 2.2.2). Many customers are switching from 2G to 3G services. The share of GSM (2G)-enabled subscriptions peaked in November 2009 (at 90 per cent) and has since been on the decline, while the share of 3G-enabled subscriptions is growing.[28] Six Brazilian operators are offering 3G services, together covering 83 per cent of the population by end 2011. There is, however, a rural/urban divide in coverage. Urban centres such as Rio de Janeiro are fully covered by a 3G network (both in terms of population and area), while more remote regions such as the very South and North lag behind.[29] The national broadband plan (PNBL) is addressing this problem, and aims to extend 3G coverage throughout the country.[30]

Fiji, the only small island developing state to feature among the most dynamic IDI countries, moved up five places to 88th in the IDI 2011, and increased its IDI by 14 per cent. This is mainly due to a huge increase in its use sub-index, which has almost doubled, from 0.82 in 2010 to 1.60 in 2011, far ahead of the average use sub-index increase of 0.31. The main factor responsible for the increase is the strong growth in mobile-broadband penetration. 3G has been available in Fiji since 2008, and has been gradually extended to cover more of the archipelago's islands and population.[34] With a fixed (wired)-broadband penetration rate of only 3 per cent, and given the geographic characteristics of the country, mobile-broadband access clearly plays an important role in connecting Fijians to the Internet. In 2011, the country published its first national broadband plan, which sets development goals for 2016, including the provision of broadband services to 95 per cent of Fijian households. Furthermore, the Fijian government is committed to making access affordable, extending e-government services and connecting schools (Fijian Government, 2011).

Improvements in both the access and use sub-indices contributed to a rise of 0.45 in IDI value for **Georgia**, which ranks 73rd in the IDI 2011. Changes in the access sub-index include an increase in households with a computer (from 18 to 24 per cent) and households with Internet access (from 17 to 23 per cent). Furthermore, Georgia is one of the few countries recording significant increases in fixed-telephone penetration, up almost six percentage points, to 31 per cent, which is the third highest penetration in the CIS region. In terms of ICT usage, both fixed (wired)-broadband and mobile-broadband penetration continue to grow, and the number of Georgians using the Internet reached 36 per cent in 2011.

Ghana, which ranks 117th in the IDI 2011, is the country with the highest relative IDI change (23 per cent). The values of both the access and use sub-indices improved, with the strongest growth in the latter. Fixed (wired)-broadband penetration remains marginal, but mobile broadband took off, with a remarkable surge in penetration from 7 per cent in 2010 to 23 per cent in 2011. This makes Ghana the country with the highest mobile-broadband penetration in Africa (Box 2.3)

Kazakhstan is among the countries registering the biggest improvement in ranking, moving up seven places to 49th position in 2011. The country's IDI increased by 13 per cent. Progress is visible across all three sub-indices. Most impressive, however, are the advances made in the use sub-index. The proportion of the population using the Internet increased from 32 per cent in 2010 to 45 per cent in 2011. While the fixed (wired)-broadband penetration rate decreased slightly, mobile-broadband penetration rose from 23 per cent to 38 per cent. In the CIS region, only the Russian Federation has a higher mobile-broadband penetration rate. Improvements in the access sub-index are ascribable mainly to an increase in mobile-cellular subscriptions. The mobile-cellular penetration rate, which was already well above the 100 per cent mark in 2010, increased to 143 per cent in 2011. Furthermore, international Internet bandwidth per Internet user more than doubled between 2010 and 2011.

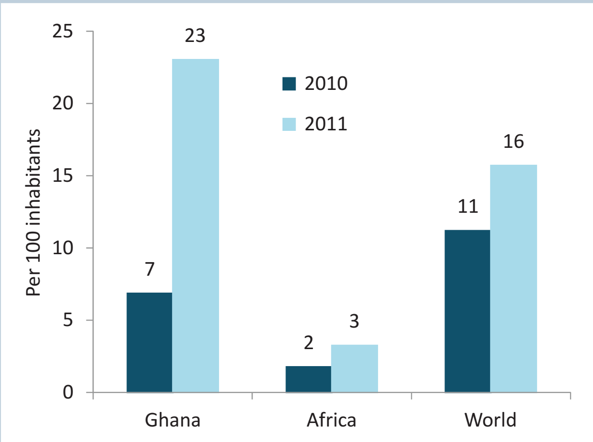
Box 2.3: Mobile-broadband penetration on the move in Ghana

Ghana is among the most dynamic countries in the IDI 2011, registering a 23 per cent increase in its IDI, from 1.81 in 2010 to 2.23 in 2011. It is similarly among the most dynamic countries in terms of rank change in both the use and access sub-indices. Nevertheless, this African nation still remains in the lower half of the IDI rankings, in 117th place.

Improvements in the access sub-index can be seen across all indicators, with the exception of fixed-telephone penetration, which stagnated. International Internet bandwidth and mobile-cellular subscriptions grew most significantly.

Underlying the growth in the use sub-index is the increase in the number of Internet users and, even more significantly, the leap in mobile-broadband penetration. Fixed (wired)-broadband penetration, on the other hand, remains negligible, at below 0.3 per cent. Some 14 per cent of Ghanaians are now Internet users, up from 10 per cent in 2010. Mobile-broadband penetration more than tripled, and stands at 23 per cent in 2011 (see Chart Box 2.3). This is an impressive jump, which puts Ghana in first place in Africa in terms of mobile-broadband penetration. Ghana's mobile market is very competitive, and five operators are providing 3G services. The country's mobile-broadband prices are relatively low (14 per cent of GNI per capita) in comparison with the African average (64 per cent of GNI per capita for prepaid handset-based usage and 54 per cent of GNI per capita for postpaid computer-based usage), according to the 2011 ITU price data-collection exercise (see Chapter 3, section 3.5). Low prices attract customers, as do the variety of tailored mobile-broadband offers available from the mobile market leader MTN. Prepaid customers can choose from various packages with different data allowances (from 25 MB to 10 GB) and validity periods (one day to 30 days).[35] Furthermore, Ghana's telecommunication sector had the highest investment-to-revenue ratio in 2009 and 2010, which shows that operators invested relatively heavily in fixed assets in order to maintain and enhance networks (see Chapter 4).

Chart Box 2.3: Active mobile-broadband subscriptions per 100 inhabitants, 2010-2011, Ghana in comparison with regional and world average



Source: ITU World Telecommunication/ICT Indicators database.

Kenya stands out in terms of relative IDI change. With an increase of 12 per cent in its IDI, the country ranks 114th in 2011, although this is still towards the bottom of the rankings. Most of the improvement is due to an increase in the percentage of Internet users, which doubled between 2010 and 2011, to 28 per cent of the population. However, fixed (wired)-broadband and mobile-broadband penetration rates are marginal, at below 1 per cent, which suggests that most devices are shared among many people or that users do not access the Internet through a broadband connection. Indeed, the majority of mobile Internet users access the Internet through 2/2.5G technologies (Communications Commission of Kenya, 2011a).

Rwanda is the only least developed country (LDC) to be among the most dynamic IDI countries. It achieved one of the highest improvements in ranking (climbing seven places), but is still low down (133rd) in the IDI 2011. Rwanda improved in both the access and the use sub-indices. The percentage of households with a computer and with Internet access both almost doubled, to 2 per cent and 5 per cent, respectively. International Internet bandwidth per Internet user more than doubled, from around 2 000 bit/s in 2010 to over 4 000 bit/s in 2011. This jump is explained by the completion of a 2 500 km fibre-optic backbone roll-out in December 2010, linking landlocked Rwanda with neighbouring Tanzania and Uganda.[36] In the use sub-index,

Figure 2.3: IDI spider charts, selected dynamic countries, 2010 and 2011

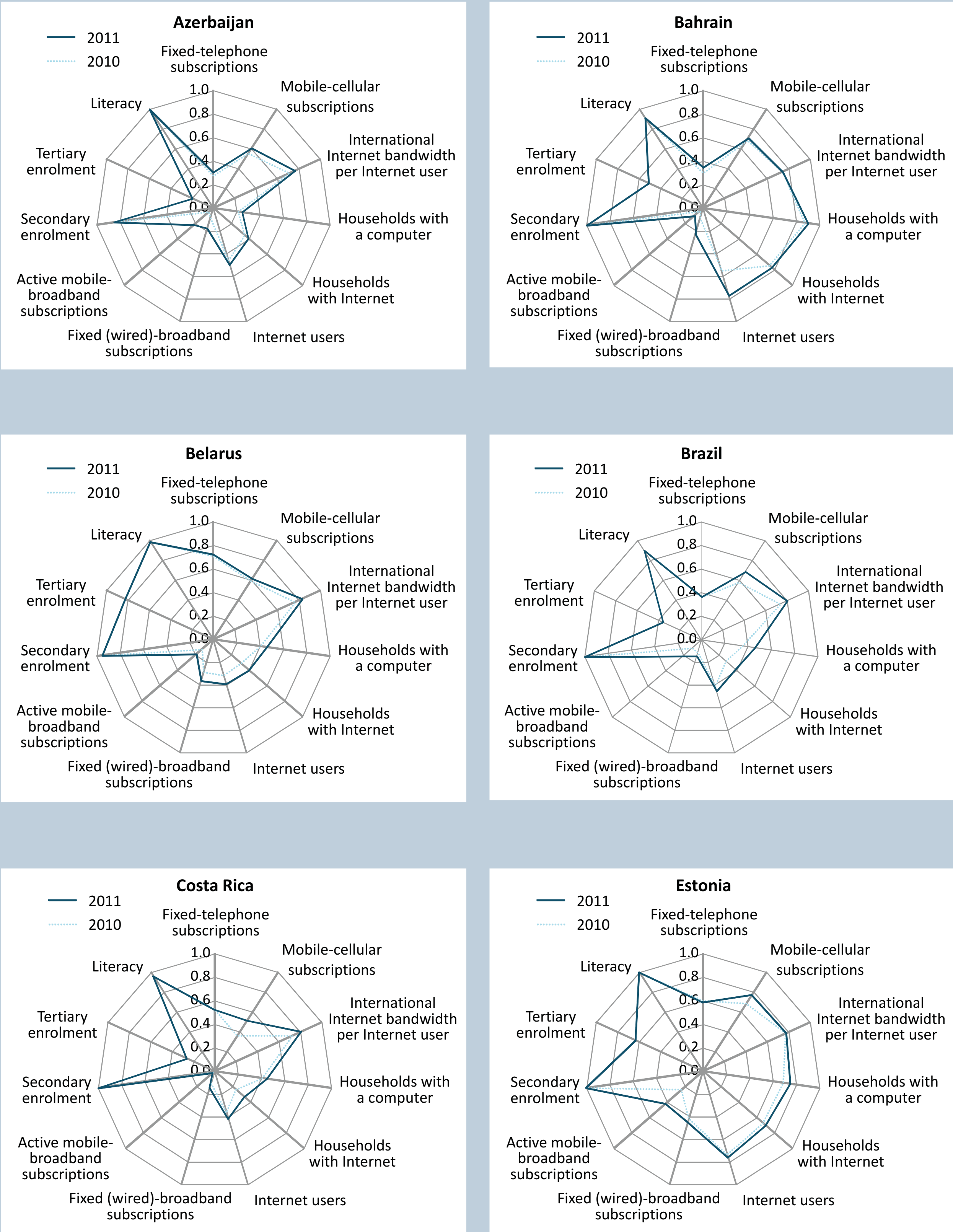


Figure 2.3: IDI spider charts, selected dynamic countries, 2010 and 2011 (continued)

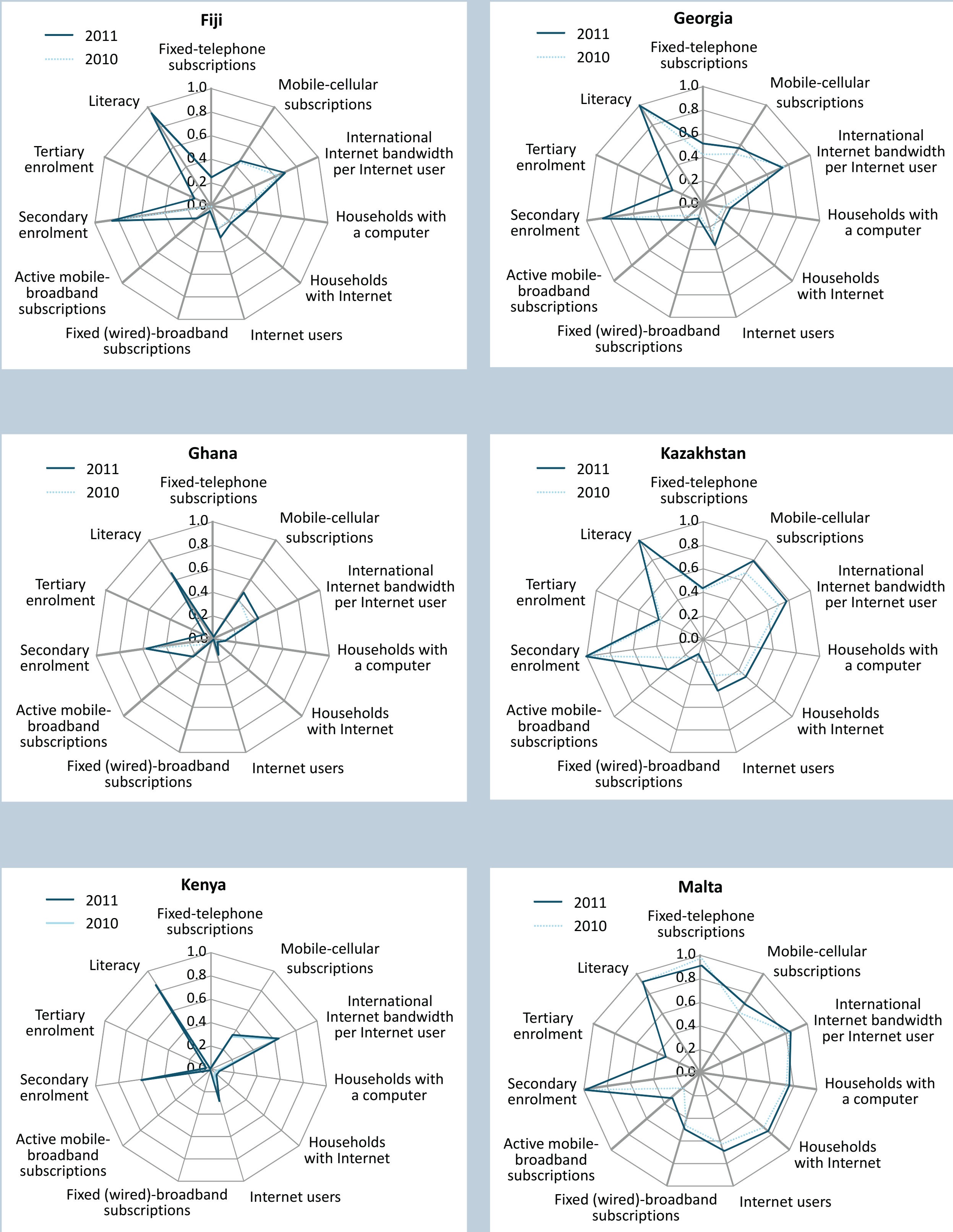
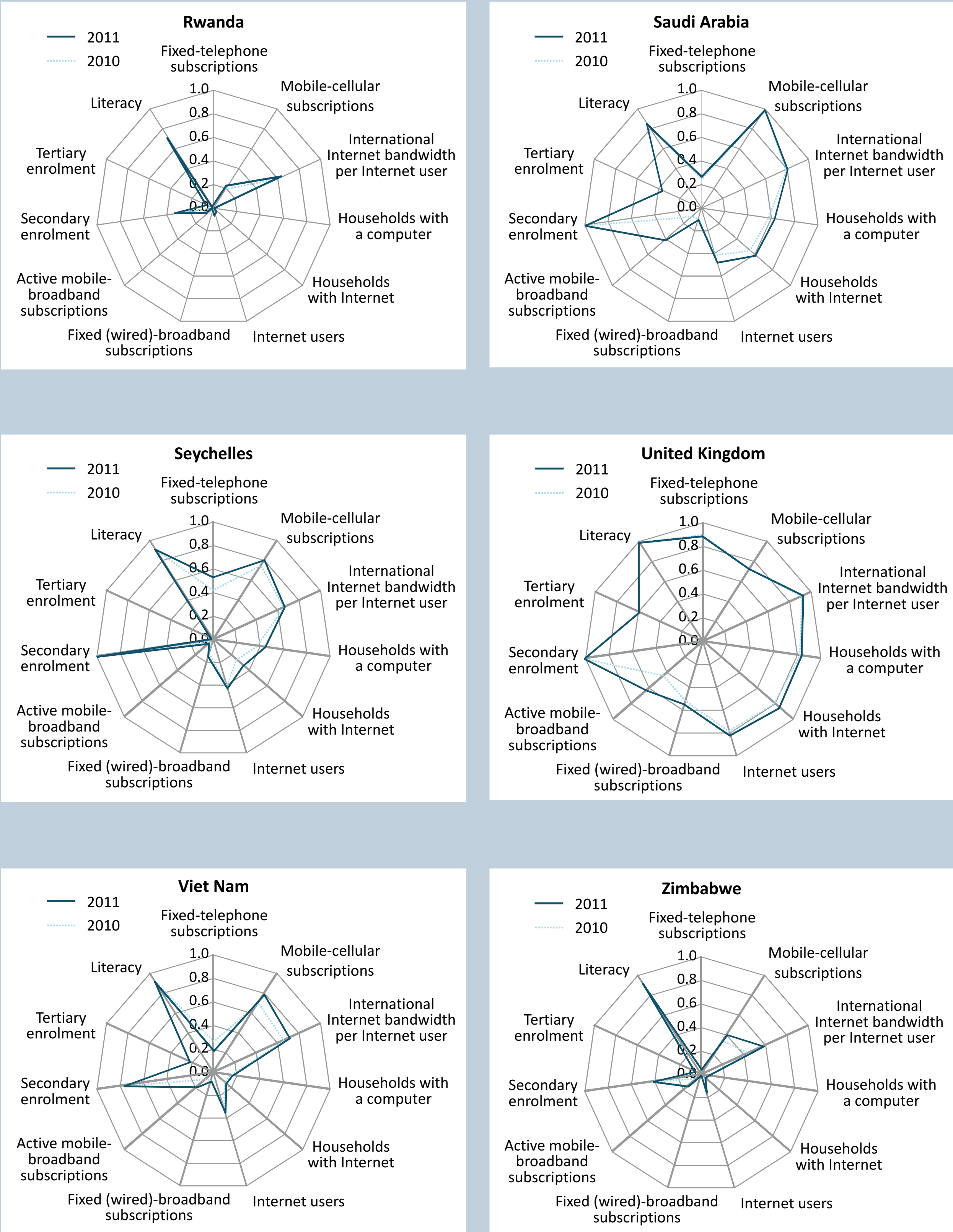


Figure 2.3: IDI spider charts, selected dynamic countries, 2010 and 2011 (continued)



Note: These charts show normalized values of the indicators included in the IDI.
Source: ITU.

mobile-broadband penetration rose from 1 per cent in 2010 to 6 per cent in 2011.

Among the countries with the largest change in absolute IDI value is **Saudi Arabia**. The country improved its IDI value by 0.62, almost three times the average IDI increase, and ranks 47th in the IDI in 2011. This progression is mainly attributable to an increase in the use sub-index value. Mobile-broadband penetration rose from 10 per cent in 2010 to 40 per cent in 2011.[37] This represents the second highest mobile-broadband penetration rate in the Arab States, after Qatar. Furthermore, almost half of Saudis are online. Saudi regulator CICT attributes this hike in Internet usage to the competitiveness of the market, which results in continuously decreasing prices. At the same time, the availability and quality of Internet services are also improving. FTTx infrastructure is being extended, and LTE was launched by all three Saudi operators in the second half of 2011 (ITU, 2012). Furthermore, services and applications relevant to Saudi Internet users (such as banking, commercial and government transactions) are expanding (CITC, 2011).

Viet Nam moved up five places to 81st in the IDI 2011. Both the access and use sub-indices showed improvement. In the access sub-index, mobile-cellular penetration and international Internet bandwidth stand out with the strongest growth rates, while fixed-telephone penetration went down. With a mobile-cellular penetration of 143 per cent, Viet Nam ranks very high globally on this indicator. The improvement in the use sub-index can be put down primarily to the increase in mobile-broadband penetration, which more than doubled, reaching 18 per cent in 2011.

Zimbabwe shows a 19 per cent increase in its IDI, and ranks 115th in the IDI 2011. It improved on both the use and the access sub-indices. The country passed the one-point mark in the use sub-index, with significant increases in the number of Internet users and in mobile-broadband penetration. The latter indicator almost tripled, reaching 15 per cent by end 2011. Fixed (wired)-broadband remains marginal, as in the majority of African countries. In the access sub-index, while very little progress has been made in household connectivity, international Internet bandwidth increased between 2010 and 2011. In March 2011, the Maputo (Mozambique) to Harare (Zimbabwe) backbone fibre connection was completed following the landing of the submarine cable EASSy in Mozambique.[38]

2.3 The digital divide and the least connected countries (LCCs)

One of the key – and persistent – questions in the ICT-for-development debate is whether the global digital divide is widening or narrowing. Depending on the specific indicator and methodological framework chosen, the answer can be one or the other.

For example, looking at mobile telephony by level of development of countries, the majority of highly developed countries have reached saturation levels, with little growth from one year to another. In developing countries, on the other hand, mobile-cellular subscriptions are still growing at double-digit rates, which implies that the developing world is catching up and the divide is narrowing.

At the same time, the digital revolution in the developed world shows no sign of a slowdown. Many developed countries are fast becoming broadband-based information societies characterized by always-on connections to the Internet and constant mobility. The simultaneous use of devices and the ownership of multiple – increasingly "smart" – devices per person and household is becoming the norm.[39] Furthermore, the Internet is not only connecting people, but also things, in what has been called the Internet of Things,[40] thereby extending the reach of smart networks. According to an OECD study, the spread of smart networks can be considered as the next stage in the development and use of the Internet (OECD, 2012a). This is enabled by service providers offering broadband Internet at ever higher speeds. Moreover, converged services are spreading rapidly, and new applications are mushrooming. In short, ICT developments in developed countries are as dynamic as ever, and developing countries need to adapt their development priorities in order to keep up with the technological progress.

In the developing world, the ubiquitous mobile phone provides an important foundation for the uptake of mobile-based Internet. With the majority of countries worldwide

having launched 3G mobile-broadband services, the prospects are promising. Fixed-broadband infrastructure, on the other hand, remains limited in most developing countries, and growth has been slow in this regard (see Chapter 1).[41] Yet fixed-broadband access is important for building and supporting an Internet-based economy, in which businesses need reliable, high-speed, always-on Internet access in order to operate in an increasingly competitive global market. In recognition of the need for ICT-driven development, many developing-country governments have put in place national broadband plans or adopted provisions for universal access to broadband, and investments in the ICT sector remain high (see Chapter 4).

Some of the barriers developing countries are still facing when it comes to ICT development include the cost of devices and connections, the (low) speed and quality of broadband connections, the limited availability of ICT services outside major urban areas and, more generally, inherent development challenges related to poverty and literacy levels.

Composite indices – such as the IDI – are useful for analysing and comparing differences in ICT development across countries, since they combine key ICT indicators into a single benchmark value.

The large differences between developed and developing countries in terms of ICT levels are clearly apparent from the IDI values, which are on average twice as high in developed (6.52) than in developing (3.24) countries. The gap is at its widest in the use sub-index. This tallies with the IDI conceptual framework, whereby countries go through different stages as their information societies evolve: having started later, the developing world is further behind in the use sub-index than in the access sub-index.

The IDI value changes for developed and developing countries over the last year (Charts 2.1 – 2.4) reveal that the highest growth rates are found in developing countries, not only on the IDI overall, but also on both the access and use sub-indices. The use sub-index, in particular, grew by 20 per cent from 2010 to 2011 in the developing world, as against 10 per cent in developed countries. As mentioned earlier in this chapter, this is partly attributable to the lower starting values in developing countries, but it also reflects

Chart 2.1: IDI by level of development

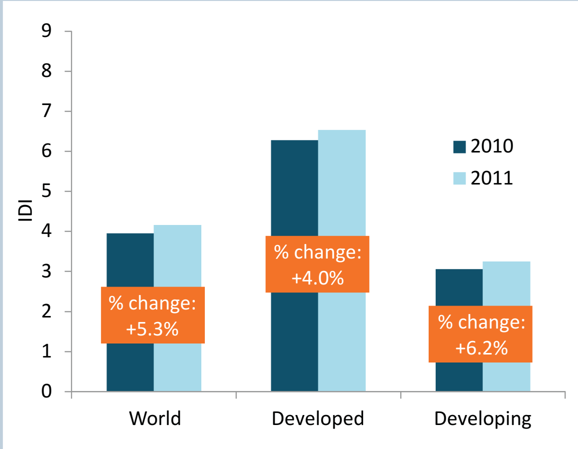


Chart 2.2: IDI access sub-index by level of development

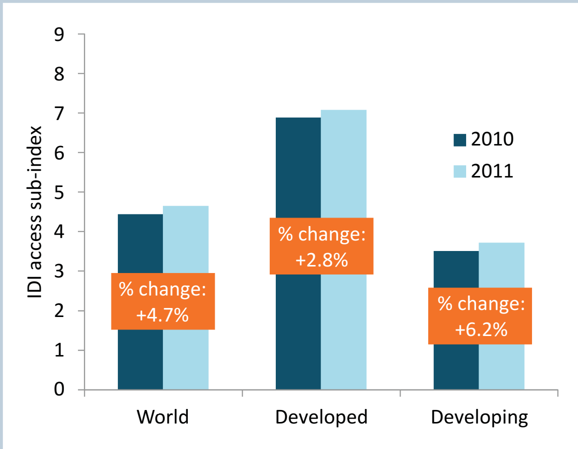
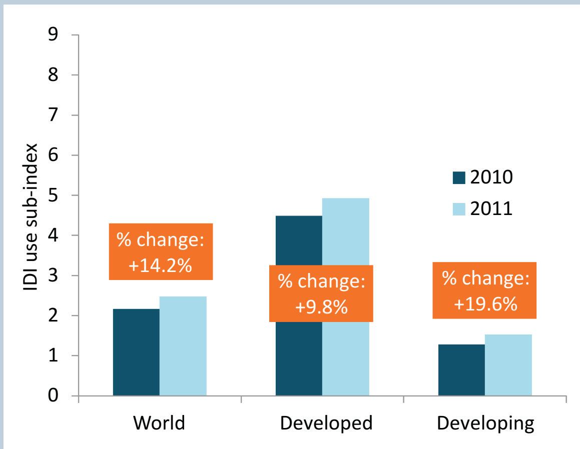
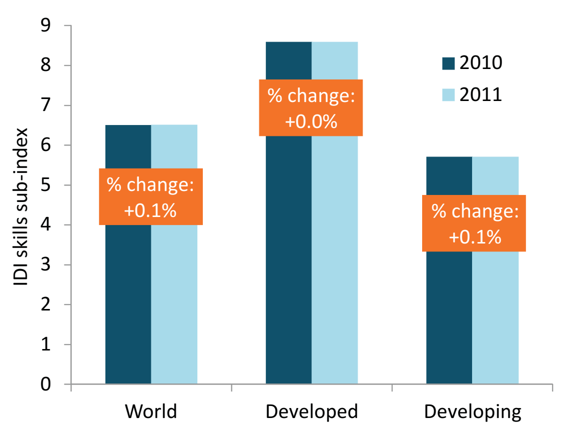


Chart 2.3: IDI use sub-index by level of development



Source: ITU.
Note: Simple averages.

Chart 2.4: IDI skills sub-index by level of development



Source: ITU.
Note: Simple averages.

the rapid uptake of ICT services such as mobile Internet. The IDI skills sub-index, on the other hand, has grown little (only 0.1 percentage points in developing countries). Advances on the indicators making up the skills sub-index are much less dynamic, although literacy skills and educational attainment are certainly important for stimulating the effective use of ICTs and their impact on development.

The IDI results presented in the previous section demonstrate that ICT uptake is growing in almost all countries – albeit at different speeds – and that the most dynamic countries are primarily from the developing world. Even in some low-income countries, ICT uptake is growing fast, as people recognize the benefits ICTs bring to them and seek to use ICT services.

The *range* of the IDI values measures the difference between the highest and the lowest country scores, and is thus a useful parameter for monitoring the evolution of differences in performance between the top and bottom IDI countries. Over the past year, the IDI range increased slightly, from 7.60 to 7.68 (Table 2.4). In other words, the IDI value of the top IDI performer increased more than that of the bottom performer (since no country experienced a decrease in IDI). Also, developed countries increased their IDI values more on average than developing countries (by 0.25 as compared with 0.19). Among the developed countries, the IDI range and its *coefficient of variation*[42] decreased between 2010 and 2011, suggesting that the group became more homogeneous. The IDI range and coefficient of variation among developing countries, on the other hand, increased, suggesting that the differences in ICT levels within that group widened.

The above analysis is limited, to the extent that it compares only two groups (developed-developing), and the developing countries group includes top ICT performers, such as the Republic of Korea, Hong Kong (China) and Singapore. A more accurate analysis of the evolution of the digital divide can therefore be obtained by grouping countries on the basis of their IDI levels and comparing changes over time. Table 2.5 shows the results of this exercise for four IDI groups (high, upper, medium and low) reflecting the different levels of IDI. Between 2010 and 2011, the IDI ranges and coefficients of variation decreased for the high, upper and medium groups. The largest decrease in range (-0.29 points) was observed in the high IDI group, which, coupled with a decrease in the coefficient of variation, indicates that this group has become more homogeneous

Table 2.4: IDI changes by level of development, 2010-2011

	IDI 2010					IDI 2011					Change in average value 2010-2011
	Average value*	SD	CV	Min.-Max.	Range	Average value*	SD	CV	Min.-Max.	Range	
World	3.94	2.08	52.60	0.85-8.45	7.60	4.15	2.13	51.31	0.88-8.56	7.68	0.21
Developed	6.27	1.17	18.69	3.48-8.21	4.73	6.52	1.15	17.59	3.78-8.34	4.56	0.25
Developing	3.05	1.60	52.35	0.85-8.45	7.60	3.24	2.12	65.54	0.88-8.56	7.68	0.19

Source: ITU.
Note: *Simple averages. SD = Standard Deviation. CV = Coefficient of Variation.

Table 2.5: IDI by groups, 2011 and 2010

		IDI 2011						IDI 2010					
Group	Number of countries	Average value	Min.	Max.	Range	SD	CV	Average value	Min.	Max.	Range	SD	CV
High	38	7.10	6.00	8.56	2.56	0.75	10.61	6.87	5.61	8.45	2.85	0.78	11.33
Upper	39	4.88	3.92	5.86	1.94	0.59	12.07	4.57	3.61	5.64	2.03	0.59	12.81
Medium	39	3.12	2.24	3.88	1.64	0.48	15.32	2.93	1.89	3.60	1.71	0.46	15.79
Low	39	1.57	0.88	2.23	1.35	0.33	20.93	1.48	0.85	1.98	1.12	0.29	19.63
Total	155	4.15	0.88	8.56	7.68	2.13	51.31	3.94	0.85	8.45	7.60	2.08	52.60

Source: ITU.
Note: SD = Standard Deviation. CV = Coefficient of variation.

in terms of ICT developments. The upper IDI group is the group where the average IDI increased most (by 0.31 points). The only group where the IDI range increased between 2010 and 2011 is the low IDI group. The low group comprises the lowest quartile of the 155 countries included in the 2011 IDI and can be termed the world's "least connected countries" (or LCCs) (see Box 2.4). The increase in IDI range and coefficient of variation in this group suggests that, contrary to the trend observed in the other groups, the group has become more heterogeneous. It is also the group with the smallest increase in average IDI value between 2010 and 2011, i.e. the one where least progress was made.

The prices end users have to pay for ICT services are a key factor in explaining the level of ICT uptake. Therefore, the ICT Price Basket (IPB) is computed as a separate metric (see Chapter 3). A comparison of IDI and IPB results shows a strong relationship between the two benchmarking tools, with an R-squared value of 0.85 (Chart 2.5). In particular, since the IPB is presented as an affordability measure, it illustrates how the relative cost of ICTs can act as a major barrier to ICT uptake in low-income countries. The countries that feature towards the bottom of the IDI are also those where ICT services are least affordable, and vice versa.

The importance of broadband pricing for driving the information society has been recognized by the Broadband Commission for Digital Development, which has chosen a broadband price threshold of 5 per cent of GNI per capita as one of four targets to be reached by 2015 (see Chapter 1, Box 1.1).

As with many development indicators, ICT indicators are strongly correlated with countries' economic performance, which can be measured, inter alia, in terms of national income levels. A regression analysis of IDI and GNI per capita, shown in Chart 2.6, indeed reveals a high R-squared value (of 0.85), confirming the strong relationship between the two variables.

One interesting aspect of this analysis is that it serves to identify those countries that perform contrarily, i.e. better (or worse) than their income levels would predict. Such countries will be positioned further away from the regression curve fitting the data in the chart. Thus, countries performing better include the Republic of Korea, Iceland, Sweden, Denmark and Finland towards the top of the IDI, but also the United Kingdom, Estonia, New Zealand and Moldova further down. Lower ICT performers in relation to their income levels include the United Arab Emirates, Brunei Darussalam, Seychelles and Trinidad and Tobago in the upper and middle parts of the IDI, and Botswana, Gabon and Turkmenistan towards the lower end of the IDI. In these countries, it may be assumed that factors other than national income levels account for their (high or low) relative ICT performance. High ICT performance can be related, for example, to effective government policies enabling the sector to grow, and an overall strong ICT industry in the country. In the lower-performing countries,

Box 2.4: The least connected countries (LCCs) – 2011

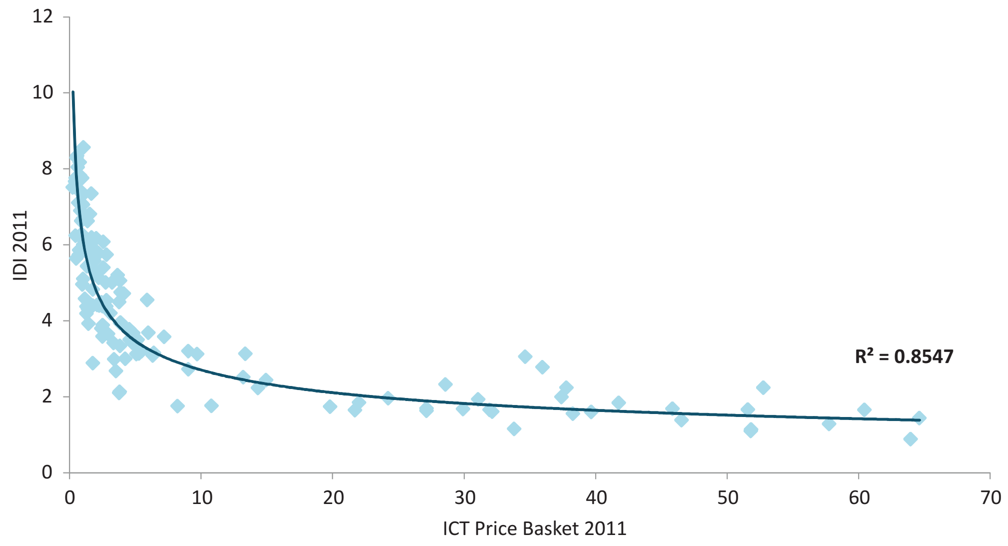
The IDI can be used to group countries on the basis of their ICT levels. In development policy and research, countries are most often grouped according to their income levels or other development criteria. While there is a strong correlation between ICT development and national income (Chart 2.6), there are nevertheless a number of countries that have achieved superior ICT performance levels to what their income levels would predict, and vice versa. Therefore, grouping countries according to ICT levels provides a more accurate basis for analysis, and can help direct and reinforce ICT policies. In particular, keen attention should be paid to the countries that have the lowest ICT – or IDI – levels, which can be termed the "least connected countries" (LCCs). Based on the 2011 IDI results, a list of the 39 LCCs is provided below. It represents the countries that are in the lowest quartile of the 155 countries included in the 2011 IDI. Predictably, the list contains many countries that are also among the low-income developing countries and the least developed countries (LDCs). However, it also includes non-LDCs, such as Ghana, India, Nigeria and Pakistan (see Table Box 2.4). Priority should be given to these countries by policy-makers at both the national and international levels when it comes to ICT-for-development.

Table Box 2.4: Least connected countries (LCCs), 2011

Country	IDI 2011	Country	IDI 2011	Country	IDI 2011	Country	IDI 2011
Ghana	2.23	Pakistan	1.75	Nepal	1.63	Mozambique	1.28
Bhutan	2.13	Djibouti	1.74	Cameroon	1.60	Guinea	1.28
India	2.10	Côte d'Ivoire	1.69	Tanzania	1.60	Liberia	1.26
Lao P.D.R.	1.99	Comoros	1.68	Congo	1.60	Ethiopia	1.15
Cambodia	1.96	Myanmar	1.67	Benin	1.55	Burkina Faso	1.14
Nigeria	1.93	Uganda	1.67	Papua New Guinea	1.44	Eritrea	1.09
Solomon Islands	1.85	Rwanda	1.66	Madagascar	1.44	Central African Rep.	0.97
Senegal	1.85	Togo	1.65	Malawi	1.42	Chad	0.94
Gambia	1.84	Zambia	1.65	Mali	1.38	Niger	0.88
Yemen	1.76	Mauritania	1.64	Congo (Dem. Rep.)	1.30		

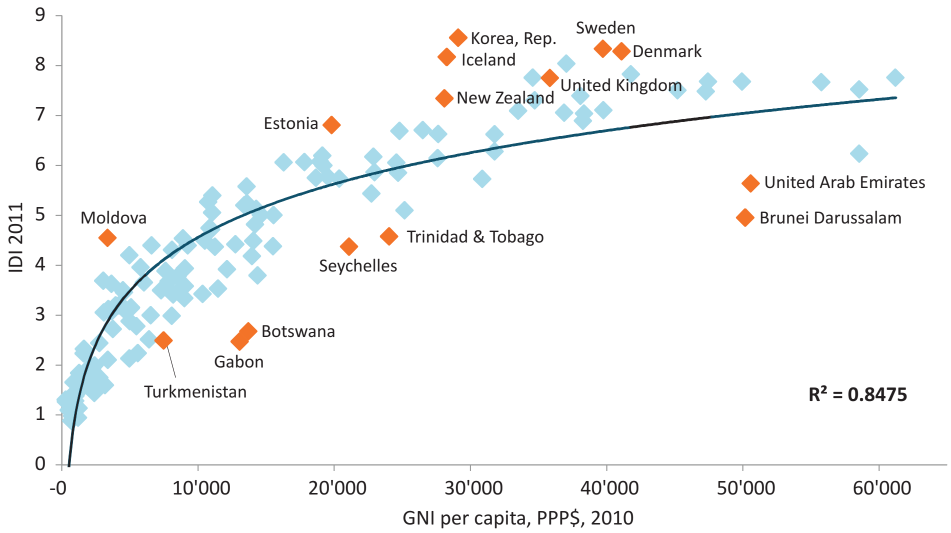
Source: ITU.

Chart 2.5: IDI and IPB, 2011



Source: ITU.

Chart 2.6: IDI and GNI per capita, 2011



Source: ITU and World Bank.

the implementation of a national ICT strategy to create an enabling environment for the ICT industry could help boost ICT development, combined with the development of relevant ICT applications and content.

2.4 IDI breakdown by sub-indices

Access sub-index

Five indicators are included in the access sub-index of the IDI: fixed-telephone subscriptions per 100 inhabitants, mobile-cellular telephone subscriptions per 100 inhabitants, international Internet bandwidth per Internet user, percentage of households with a computer and percentage of households with Internet access at home. These indicators measure ICT infrastructure and readiness, which are the foundation for ICT usage and impact.

Hong Kong (China) ranks at the top of the access sub-index, with a value of 9.21, reflecting its remarkable achievements in terms of expanding ICT infrastructure and bandwidth (see Box 2.5). It is followed by the European countries Switzerland, Luxembourg, Iceland and Germany, all of which also rank in the top 20 in the overall IDI (see Table 2.2). The range of the access sub-index of the IDI, calculated by deducting the lowest from the highest value, is 8.36, the second highest after the skills sub-index range. While, as mentioned, Hong Kong (China)'s IDI value exceeds nine, Eritrea ranks last with a sub-index value of 0.85 (see Table 2.6).

Table 2.7 shows the top ten economies registering the greatest changes in the IDI access sub-index from 2010 to 2011 in terms of value and rank. In most of the dynamic countries in the access sub-index, the change was visible across all the indicators included in the sub-index, with the exception of fixed telephony, which stagnated from 2010 to 2011. This is the case, for instance, in Brazil (see Box 2.2), the country with the highest increase in access sub-index value (+0.78), where mobile-cellular penetration increased from 104 to 123 per 100 inhabitants, international Internet bandwidth per Internet user more than doubled and significant increases were also recorded in ICT household access from 2010 to 2011. The picture is similar for Costa Rica, the country with the second highest increase in access sub-index value (+0.72), where mobile-cellular penetration increased from 65 to 92 per 100 inhabitants, international Internet bandwidth tripled and the percentage of households with a computer and with access to the Internet greatly improved from 2010 to 2011.

Table 2.6: IDI access sub-index, 2010 and 2011

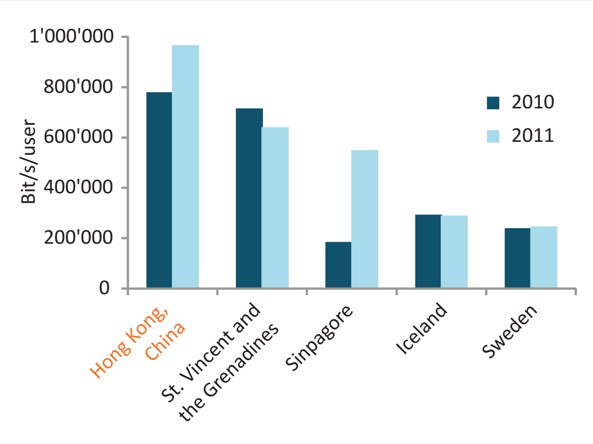
Economy	Rank 2011	Access 2011	Rank 2010	Access 2010
Hong Kong, China	1	9.21	1	9.09
Switzerland	2	8.89	4	8.69
Luxembourg	3	8.87	3	8.75
Iceland	4	8.81	2	8.83
Germany	5	8.66	5	8.51
Sweden	6	8.50	6	8.51
United Kingdom	7	8.47	7	8.33
Singapore	8	8.38	12	8.12
Denmark	9	8.37	8	8.29
Netherlands	10	8.34	9	8.24
Korea (Rep.)	11	8.30	11	8.17
Norway	12	8.28	10	8.21
Macao, China	13	7.96	13	7.81
France	14	7.92	14	7.72
Malta	15	7.90	15	7.69
Austria	16	7.88	16	7.68
Japan	17	7.81	17	7.60
Finland	18	7.74	18	7.56
Belgium	19	7.72	19	7.49
Australia	20	7.66	20	7.46
Ireland	21	7.64	23	7.39
New Zealand	22	7.61	21	7.42
Canada	23	7.54	22	7.40
United States	24	7.50	24	7.20
Israel	25	7.34	25	7.18
Slovenia	26	7.29	26	7.16
Estonia	27	7.20	30	6.86
Barbados	28	7.15	29	6.89
Spain	29	7.12	28	6.96
Italy	30	7.11	27	7.03
Antigua & Barbuda	31	6.99	33	6.69
Portugal	32	6.94	32	6.77
Bahrain	33	6.94	34	6.68
Qatar	34	6.90	31	6.82
United Arab Emirates	35	6.89	35	6.63
Russian Federation	36	6.69	39	6.42
Croatia	37	6.67	36	6.52
Saudi Arabia	38	6.63	43	6.33
Lithuania	39	6.60	38	6.43
Greece	40	6.56	37	6.52
Czech Republic	41	6.53	40	6.33
Hungary	42	6.48	42	6.33
Poland	43	6.46	44	6.31
Brunei Darussalam	44	6.46	41	6.33
Cyprus	45	6.46	45	6.25
Serbia	46	6.37	47	6.11
Slovakia	47	6.32	46	6.12
Uruguay	48	6.15	50	5.70
Latvia	49	6.13	48	5.98
Belarus	50	6.13	52	5.62
St. Vincent and the G.	51	6.09	49	5.91
Bulgaria	52	5.97	53	5.58
Kazakhstan	53	5.97	59	5.40
Malaysia	54	5.85	51	5.66
Romania	55	5.75	56	5.48
TFYR Macedonia	56	5.73	54	5.53
Saint Lucia	57	5.72	58	5.48
Moldova	58	5.69	61	5.25
Argentina	59	5.66	55	5.49
Seychelles	60	5.61	65	4.96
Oman	61	5.60	60	5.32
Trinidad & Tobago	62	5.59	57	5.48
Maldives	63	5.53	62	5.20
Lebanon	64	5.44	67	4.82
Chile	65	5.42	64	5.12
Brazil	66	5.35	70	4.58
Costa Rica	67	5.28	71	4.55
Panama	68	5.16	63	5.14
Turkey	69	5.12	66	4.93
Mauritius	70	5.01	68	4.76
Ukraine	71	4.86	69	4.66
Bosnia and Herzegovina	72	4.67	72	4.43
Jordan	73	4.64	75	4.20
Azerbaijan	74	4.63	74	4.20
Georgia	75	4.61	76	4.10
Morocco	76	4.49	78	4.00
Iran (I.R.)	77	4.47	73	4.26
Syria	78	4.19	79	3.93
Egypt	79	4.18	77	4.01
Colombia	80	4.17	80	3.92
Ecuador	81	4.16	86	3.78
China	82	4.12	83	3.83
Mexico	83	4.08	81	3.90
Venezuela	84	4.01	85	3.81
Viet Nam	85	4.00	84	3.81
Jamaica	86	3.96	82	3.87
Tunisia	87	3.91	87	3.67
Peru	88	3.87	88	3.61
Fiji	89	3.85	90	3.58
South Africa	90	3.79	93	3.45
Thailand	91	3.78	89	3.60
Mongolia	92	3.76	92	3.52
El Salvador	93	3.72	91	3.58
Albania	94	3.59	96	3.32
Paraguay	95	3.55	99	3.26
Algeria	96	3.53	97	3.29
Botswana	97	3.50	103	3.11
Dominican Rep.	98	3.37	95	3.33
Indonesia	99	3.37	98	3.28
Gabon	100	3.35	100	3.21
Philippines	101	3.32	105	3.09
Tonga	102	3.30	101	3.17
Sri Lanka	103	3.30	102	3.11
Guyana	104	3.23	104	3.10
Bolivia	105	3.23	106	2.99
Honduras	106	3.21	94	3.42
Cape Verde	107	3.13	107	2.90
Namibia	108	3.03	109	2.56
Nicaragua	109	2.83	110	2.55
Tuvalu	110	2.68	114	2.38
Turkmenistan	111	2.62	108	2.58
Côte d'Ivoire	112	2.59	112	2.40
Cambodia	113	2.53	111	2.43
Uzbekistan	114	2.52	118	2.25
Mauritania	115	2.50	121	2.22
India	116	2.48	115	2.33
Swaziland	117	2.47	117	2.28
Gambia	118	2.47	116	2.31
Pakistan	119	2.46	113	2.39
Lao P.D.R.	120	2.45	124	2.18
Bhutan	121	2.44	120	2.24
Senegal	122	2.36	119	2.25
Benin	123	2.36	122	2.21
Kenya	124	2.34	123	2.19
Zimbabwe	125	2.25	130	1.85
Mali	126	2.19	129	1.87
Togo	127	2.18	126	2.06
Djibouti	128	2.14	125	2.09
Ghana	129	2.10	134	1.73
Solomon Islands	130	2.04	133	1.77
Congo (Rep. of the)	131	1.93	128	1.88
Yemen	132	1.92	127	1.88
Uganda	133	1.91	142	1.63
Rwanda	134	1.90	140	1.64
Papua New Guinea	135	1.89	135	1.72
Comoros	136	1.88	132	1.80
Madagascar	137	1.87	131	1.82
Nepal	138	1.87	136	1.71
Nigeria	139	1.86	143	1.63
Tanzania	140	1.85	137	1.68
Burkina Faso	141	1.82	138	1.68
Cameroon	142	1.77	139	1.65
Zambia	143	1.74	147	1.50
Guinea	144	1.71	141	1.63
Mozambique	145	1.66	144	1.61
Ethiopia	146	1.64	146	1.51
Liberia	147	1.59	149	1.47
Malawi	148	1.55	145	1.55
Myanmar	149	1.52	148	1.49
Niger	150	1.44	150	1.46
Cuba	151	1.43	151	1.38
Congo (Dem. Rep.)	152	1.37	153	1.07
Chad	153	1.28	154	1.05
Central African Rep.	154	1.19	152	1.15
Eritrea	155	0.85	155	0.85

Source: ITU.

Box 2.5: Hong Kong (China): Asia and the Pacific's high-density, high-speed broadband hub

For the second year in a row, Hong Kong (China) ranks first in the access sub-index, with an impressive value of 9.21. Its international Internet bandwidth per Internet user is the highest of all economies included in the IDI (see Chart Box 2.5). Hong Kong (China)'s regulator has made it a policy priority to attract new submarine cables.[46] The city state already stands out in international comparison and is poised to hold onto its outstanding position with the landing of a tenth submarine cable, the Asia Submarine-cable Express (ASE), by end 2012. According to OFCA, the landing of ACE "will further strengthen our [Hong Kong (China)'s] position as the telecommunications and Internet hub in the Asia Pacific region".[47] Broadband infrastructure does not stop at the landing stations. According to OFCA, fibre-to-the-home/building household penetration stood at 45 per cent in February 2012.[48] Even though this already represents one of the highest rates worldwide, further measures are being taken to increase penetration. A registration scheme for residential buildings was started in late 2010 to take stock of buildings connected, in combination with a promotional campaign to further increase public awareness of FTTH.[49]

Chart Box 2.5: International Internet bandwidth per Internet user, top five economies for this indicator, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

A highly developed broadband infrastructure, low prices and a high level of competition (185 ISPs were licensed as of February 2012) resulted in a fixed (wired)-broadband penetration of 32 per cent in 2011, one of the highest rates worldwide. Mobile-broadband penetration has seen impressive growth, from 39 per cent in 2010 to 52 per cent in 2011. The city state is home to four 3G operators employing a variety of mobile-broadband technologies (including HSDPA, HSPA+ and W-CDMA). LTE is being gradually deployed by three operators, which will further increase the speed and quality of mobile-broadband services.[50] In order to sustain market growth, OFCA works with mobile-broadband operators to publish service performance statistics "covering aspects related to network reliability, service restoration time, customer hotline performance, customer complaint handling and technical performance."[51] Furthermore, the OFCA Broadband Performance Test has been developed, allowing customers to measure fixed- and mobile-broadband performance and speeds.[52]

The most dynamic countries in terms of the access sub-index are all developing countries (with the exception of Belarus), many ranked low in the IDI. Most notably, the top ten most dynamic countries in terms of the access sub-index include the African LDCs Uganda and Rwanda, as well as the Arab LDC Mauritania. Whereas top IDI performers already have a highly developed ICT infrastructure, many developing countries are building and enhancing ICT readiness, which will eventually also lead to increases in ICT use and impact.

The number of mobile-cellular subscriptions continued to grow at double-digit rates in almost 60 of the economies included in the IDI. The biggest growth is taking place in developing countries, with Namibia showing one of the highest increases, reaching 105 per cent penetration by end 2011.[53] Other African countries with high mobile-cellular growth rates include Botswana and South Africa, where penetration has passed the 100 per cent mark, and Uganda, where penetration stands at 48 per cent in 2011. Penetration rates in developed countries are stagnating, most countries having reached saturation levels. By end 2011, mobile-cellular penetration had already moved beyond 100 per cent in 83 countries (out of 155 included in the IDI), and in a total of 132 countries it has passed the 50 per cent mark.

International Internet bandwidth per Internet user continues to increase in most countries. As mentioned

Table 2.7: Top ten economies with greatest 2010-2011 change in the IDI access sub-index, by absolute value change (left) and rank change (right)

IDI rank 2011	Access rank 2011	Country	Access value change 2010-2011
60	66	Brazil	0.78
71	67	Costa Rica	0.72
70	60	Seychelles	0.65
65	64	Lebanon	0.62
49	53	Kazakhstan	0.57
46	50	Belarus	0.51
73	75	Georgia	0.51
90	76	Morocco	0.49
109	108	Namibia	0.47
50	48	Uruguay	0.45

IDI rank 2011	Access rank 2011	Country	Access value change 2010-2011
132	133	Uganda	9
49	53	Kazakhstan	6
108	97	Botswana	6
136	115	Mauritania	6
133	134	Rwanda	6
70	60	Seychelles	5
115	125	Zimbabwe	5
82	81	Ecuador	5
117	129	Ghana	5
47	38	Saudi Arabia	5

Source: ITU.

earlier, Hong Kong (China) stands out for having by far the most bandwidth per Internet user and, together with Singapore, records the highest absolute gains in bandwidth per Internet user in 2011 (see Box 2.5). International Internet bandwidth per Internet user more than doubled in Belarus and Kazakhstan from 2010 to 2011. Significant increases were also achieved in both Zimbabwe and Rwanda, albeit at much lower levels, with the roll-out of a national fibre-optic backbone connecting these landlocked countries to the international network.[54] In Ecuador, international Internet bandwidth per Internet user more than tripled, and the country now has one of the highest bandwidth per Internet user ratios in the Americas region.

There is quite a divide in terms of ICT household penetration between high-income countries, on the one hand, and lower- and middle-income countries, on the other. For example, while a number of European high-income countries boast top penetration levels of over 90 per cent for both households with a computer and households with Internet access, some African LDCs have household penetration rates of around just 1 per cent. Growth in household connectivity is much slower than growth in mobile-cellular penetration or Internet bandwidth, for instance. Nevertheless, the percentage of households with a computer and with Internet access is growing steadily.

Brazil and Lebanon stand out for above-average increases in the percentage of both households with a computer and households with Internet access, improving their access sub-index values by more than three times the average increase of 0.21. Household connectivity in Brazil rose from relatively low levels to 45 per cent of households with a computer and 38 per cent of households with Internet access (see Box 2.2). Lebanon already had a relatively high ICT household penetration rate, which it managed to increase further, to 72 per cent of households with a computer and 62 per cent of households with Internet access (see Box 2.6). Whereas in Lebanon mobile-broadband penetration is marginal, mobile broadband plays an important role in Brazil, where it has helped to bring Internet access to many homes. Other countries with impressive increases in terms of household ICT access include Uruguay, Morocco, Seychelles and Jordan.

Fixed-telephone penetration is by far the least dynamic indicator in the IDI. In no fewer than 100 of the 155 countries included in the IDI, penetration fell between 2010 and 2011. Exceptions are Seychelles and Georgia, where fixed-telephone penetration increased by 7 and 6 percentage points, respectively, contributing to impressive growth in the access sub-index for these countries.

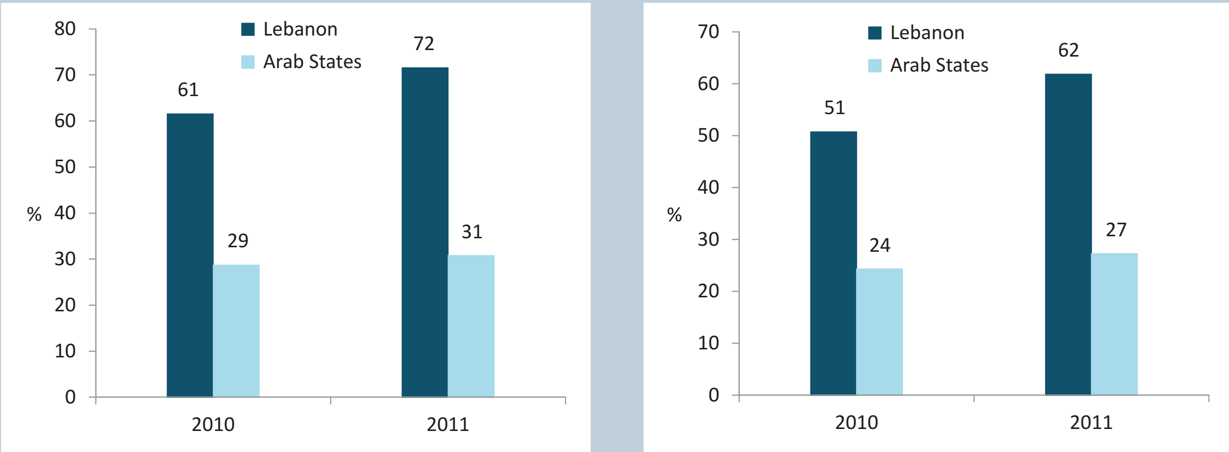
Box 2.6: Towards a connected Republic of Lebanon

Lebanon improved its access sub-index by 0.62 (compared with an average change of 0.21) and the country now sits in 64th position in the sub-index ranking, and 65th in the overall IDI ranking. All the indicators used to measure the access sub-index, except for fixed-telephone penetration, show impressive growth rates from 2010 to 2011. The number of mobile-cellular subscriptions and the percentages of households with a computer and households with Internet access all increased by about 10 per cent. International Internet bandwidth per Internet user almost doubled, with the India-Middle East-Western Europe (IMEWE) submarine cable going live in 2011.[55]

The percentages of Lebanese households with a computer (72 per cent) and with Internet access (62 per cent) stand out as being among the highest in the region (see Chart Box 2.6). Only the Arab region's high-income GCC countries have greater household connectivity rates. A survey carried out by the National ICT strategy Office found that the majority of Lebanese Internet users access the Internet at home (84 per cent), and that most households (84 per cent) access via a fixed (wired)-broadband connection. Mobile broadband does not play an important role as an access technology, with only 2 per cent of households connecting via 3G networks (Presidency of the Council of Ministers, 2012). The national ICT action plan envisions a "connected Republic of Lebanon, connected to its people, connected to the world". A priority goal is to bring broadband Internet to 1 million out of a total of just over 4 million Lebanese, and to provide high speeds (10 Mbit/s) to private customers in densely-populated cities by 2015 (Republic of Lebanon, 2012).

While Lebanon's access sub-index is steadily improving, its use sub-index values are still low. With a use sub-index value of 2.02, the country ranks 74th in the sub-index, behind countries such as Oman and Morocco. The impressive achievements made in the access sub-index are thus yet to translate into higher ICT usage rates.

Chart Box 2.6: Percentage of households with a computer (left) and percentage of households with Internet (right), Lebanon in comparison with regional average, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

Use sub-index

The use sub-index of the IDI is calculated on the basis of three indicators: Internet users per 100 inhabitants, fixed (wired)-broadband subscriptions per 100 inhabitants and active mobile-broadband subscriptions per 100 inhabitants. These indicators have been chosen so as to capture uptake of ICTs as well as intensity of usage. The choice of fixed (wired)-broadband and mobile-broadband indicators underlines the importance accorded to high-speed, high-capacity access, which is indispensable in order to make full use of the Internet.

The three countries topping the use sub-index are the same as for the overall IDI, namely Republic of Korea, Sweden and Denmark (see Table 2.8). Furthermore, with the exception

Table 2.8: IDI use sub-index, 2010 and 2011

Economy	Rank 2011	Use 2011	Rank 2010	Use 2010
Korea (Rep.)	1	8.17	1	8.04
Sweden	2	7.84	2	7.53
Denmark	3	7.79	4	7.17
Finland	4	7.51	3	7.33
Japan	5	7.29	5	7.03
Singapore	6	7.24	6	7.02
Luxembourg	7	7.07	7	6.90
Iceland	8	7.07	8	6.53
Netherlands	9	6.86	10	6.40
Macao, China	10	6.63	9	6.46
United Kingdom	11	6.62	14	5.75
United States	12	6.37	13	5.75
Switzerland	13	6.21	11	5.92
France	14	6.12	12	5.77
New Zealand	15	6.06	17	5.46
Norway	16	5.97	16	5.71
Hong Kong, China	17	5.96	18	5.35
Ireland	18	5.76	15	5.75
Germany	19	5.73	19	5.35
Canada	20	5.64	20	5.34
Austria	21	5.57	21	4.85
Estonia	22	5.45	24	4.66
Australia	23	5.39	22	4.83
Qatar	24	5.38	23	4.72
Belgium	25	5.07	26	4.57
Malta	26	5.06	30	4.32
Israel	27	5.02	25	4.64
Spain	28	4.92	29	4.32
Latvia	29	4.77	31	4.27
Slovenia	30	4.75	27	4.46
Czech Republic	31	4.73	32	4.23
Poland	32	4.57	28	4.46
Slovakia	33	4.30	33	3.91
Italy	34	4.20	34	3.90
Greece	35	4.02	39	3.40
Lithuania	36	3.97	36	3.68
Portugal	37	3.92	37	3.61
Russian Federation	38	3.90	42	3.20
Antigua & Barbuda	39	3.76	44	3.11
Cyprus	40	3.73	35	3.72
United Arab Emirates	41	3.66	40	3.35
Croatia	42	3.66	41	3.27
Bahrain	43	3.65	57	2.25
Hungary	44	3.63	43	3.17
Oman	45	3.63	46	3.03
Barbados	46	3.62	38	3.48
Saudi Arabia	47	3.24	61	2.00
TFYR Macedonia	48	3.24	45	3.04
Kazakhstan	49	3.19	55	2.32
Belarus	50	3.17	51	2.44
Serbia	51	3.15	49	2.53
Bulgaria	52	3.04	47	2.61
Chile	53	3.01	53	2.36
Azerbaijan	54	2.98	63	1.98
Bosnia and Herzegovina	55	2.94	52	2.37
Malaysia	56	2.85	48	2.57
Romania	57	2.79	50	2.46
Uruguay	58	2.76	54	2.34
Brazil	59	2.67	59	2.08
Argentina	60	2.56	60	2.03
Trinidad & Tobago	61	2.52	58	2.23
Brunei Darussalam	62	2.38	56	2.25
Panama	63	2.34	67	1.85
Georgia	64	2.32	72	1.71
Turkey	65	2.26	64	1.93
China	66	2.24	69	1.78
Albania	67	2.17	73	1.68
St. Vincent and the G.	68	2.15	65	1.92
Seychelles	69	2.09	68	1.82
Mauritius	70	2.07	70	1.74
Saint Lucia	71	2.07	62	1.98
Morocco	72	2.07	66	1.88
Maldives	73	2.06	81	1.43
Lebanon	74	2.02	71	1.72
Egypt	75	2.01	75	1.65
Viet Nam	76	2.01	79	1.52
Costa Rica	77	1.95	78	1.61
Mexico	78	1.95	74	1.65
Moldova	79	1.93	77	1.61
Colombia	80	1.85	76	1.61
Tunisia	81	1.67	80	1.51
Dominican Rep.	82	1.66	85	1.33
Uzbekistan	83	1.65	89	1.19
Ecuador	84	1.62	84	1.35
Fiji	85	1.60	100	0.82
Ukraine	86	1.56	86	1.28
Venezuela	87	1.53	82	1.39
Jordan	88	1.50	91	1.08
South Africa	89	1.46	87	1.26
Peru	90	1.46	83	1.36
Cape Verde	91	1.41	90	1.18
Indonesia	92	1.40	93	1.04
Jamaica	93	1.31	88	1.21
Tuvalu	94	1.25	96	0.97
Ghana	95	1.25	108	0.56
Mongolia	96	1.25	99	0.82
Guyana	97	1.20	92	1.08
Philippines	98	1.18	94	1.01
Bolivia	99	1.10	97	0.83
Thailand	100	1.09	95	1.00
Nigeria	101	1.05	98	0.82
Zimbabwe	102	1.03	107	0.56
Paraguay	103	1.00	101	0.77
Kenya	104	0.95	114	0.47
Tonga	105	0.90	105	0.59
El Salvador	106	0.89	102	0.76
Iran (I.R.)	107	0.83	104	0.60
Bhutan	108	0.83	111	0.53
Syria	109	0.81	103	0.73
Cuba	110	0.78	110	0.53
Senegal	111	0.67	106	0.57
Sri Lanka	112	0.67	112	0.51
Honduras	113	0.65	118	0.41
Swaziland	114	0.64	120	0.38
Algeria	115	0.62	109	0.56
Namibia	116	0.56	117	0.42
Uganda	117	0.54	113	0.48
Yemen	118	0.52	116	0.43
Nicaragua	119	0.49	115	0.45
India	120	0.45	124	0.30
Rwanda	121	0.45	123	0.31
Tanzania	122	0.44	119	0.40
Zambia	123	0.40	121	0.35
Gambia	124	0.38	122	0.32
Lao P.D.R.	125	0.36	129	0.26
Solomon Islands	126	0.35	131	0.19
Pakistan	127	0.33	125	0.29
Botswana	128	0.33	126	0.28
Nepal	129	0.32	127	0.28
Djibouti	130	0.30	128	0.27
Gabon	131	0.28	130	0.26
Congo (Rep. of the)	132	0.23	134	0.17
Malawi	133	0.22	141	0.10
Eritrea	134	0.21	132	0.18
Cambodia	135	0.19	143	0.08
Comoros	136	0.18	133	0.17
Mozambique	137	0.18	135	0.16
Mauritania	138	0.18	136	0.16
Turkmenistan	139	0.17	140	0.10
Cameroon	140	0.17	137	0.14
Togo	141	0.14	139	0.10
Benin	142	0.12	138	0.11
Liberia	143	0.11	145	0.08
Burkina Faso	144	0.10	142	0.08
Mali	145	0.08	144	0.08
Côte d'Ivoire	146	0.08	146	0.07
Central African Rep.	147	0.07	147	0.07
Papua New Guinea	148	0.07	150	0.05
Madagascar	149	0.07	148	0.06
Chad	150	0.06	149	0.06
Ethiopia	151	0.05	152	0.03
Niger	152	0.04	153	0.03
Guinea	153	0.04	151	0.03
Congo (Dem. Rep.)	154	0.04	154	0.02
Myanmar	155	0.04	155	0.01

Source: ITU.

of Norway, France and Hong Kong (China), all the top 15 economies in the overall IDI are in the top 15 in the use sub-index (see Table 2.6). This again confirms the fundamental assumption of the IDI, i.e. that societies go through different stages and the most advanced will have the highest ICT usage levels. For societies to reach a high level of ICT usage, they need a high degree of ICT readiness and infrastructure (access sub-index) and ICT capabilities (skills sub-index).

The use sub-index has the smallest range of all three IDI sub-indices. Nonetheless, the first-ranked (Republic of Korea) and last-ranked (Myanmar) countries are still separated by a full 8.13 points. While the use sub-index contains the lowest values of all the sub-indices, it has been the most dynamic for the period from 2010 to 2011. On average, the use sub-index increased by 0.31 from 2010 to 2011, as compared with an increase of 0.21 for the overall IDI. Furthermore, the majority of countries with the highest increases in overall IDI also feature in the top ten most dynamic countries in the use sub-index, most notably Bahrain (see Box 2.1), Fiji and Saudi Arabia (see Table 2.9). In these countries, changes in the use sub-index were very impressive, and contributed to significant improvements in the overall IDI.

Cambodia, Maldives and Malta feature among the most dynamic countries only in the use sub-index, and not the overall IDI. In Maldives and Malta, the access sub-index value was already relatively high, and the use sub-index value is now beginning to catch up. Maldives, for example, has an above-average access sub-index value (5.53), while its use sub-index value (2.06), although dynamic, remains below the world average. As in most other countries, the firmest growth is found in the number of mobile-broadband subscriptions, which went up from 7 per 100 inhabitants in 2010 to 17 per 100 inhabitants in 2011.

The spread of mobile Internet is driving ICT usage, and the number of active mobile-broadband subscriptions exceeded 1 billion in 2011. By end 2011, more than 160 economies had launched 3G services commercially, and 45 per cent of the world's population were covered by a 3G signal. Looking to the future, mobile broadband is far from saturation, and is expected to expand further and boost Internet usage. Mobile-broadband penetration is by far the most dynamic indicator, and is in most cases the main reason for increases in countries' use sub-index values. Penetration rates have risen significantly in a number of developed and developing countries alike. The United Kingdom, Estonia and Austria, where mobile-broadband penetration was already at quite high levels in 2010, attained penetration rates of 62, 42 and 43 per cent by end 2011, respectively. In

Table 2.9: Top ten economies with greatest 2010-2011 change in the IDI use sub-index, by absolute value change (left) and rank change (right)

IDI rank 2011	Use rank 2011	Country	Use value change 2010-2011
40	43	Bahrain	1.40
47	47	Saudi Arabia	1.25
68	54	Azerbaijan	1.00
49	49	Kazakhstan	0.88
10	11	United Kingdom	0.87
24	22	Estonia	0.79
88	85	Fiji	0.78
26	26	Malta	0.74
46	50	Belarus	0.73
19	21	Austria	0.72

IDI rank 2011	Use rank 2011	Country	Use value change 2010-2011
88	85	Fiji	15
40	43	Bahrain	14
47	47	Saudi Arabia	14
117	95	Ghana	13
114	104	Kenya	10
68	54	Azerbaijan	9
72	73	Maldives	8
73	64	Georgia	8
144	133	Malawi	8
121	135	Cambodia	8

Source: ITU.

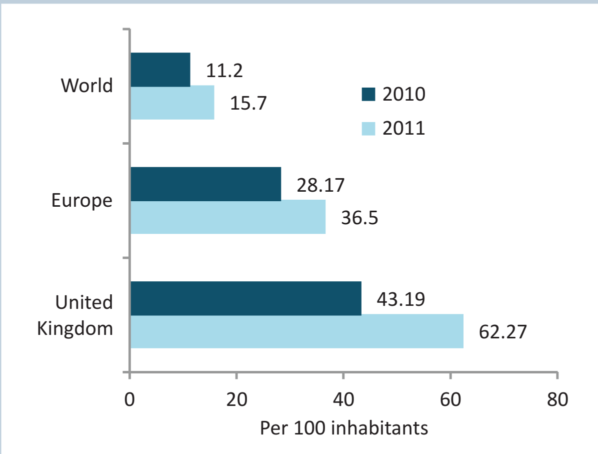
Box 2.7: Smartphone revolution in the United Kingdom

The United Kingdom is among the most dynamic countries in the IDI, improving its ranking by five places to ninth position. It is one of the few developed countries among the most dynamic performers, and is the highest ranked economy to further improve its position significantly.

The United Kingdom achieved a very high access sub-index (8.47), with top results on all its constituent indicators. While fixed-telephone and mobile-cellular penetration rates are stagnating, international Internet bandwidth continues to increase and more and more households are coming online. Whereas the access sub-index only shows minor gains (0.14 value points), growth in the use sub-index is outstanding. The country improved its use sub-index by 0.87, almost three times the global average progression. Fixed (wired)-broadband penetration, already at very high levels, further increased from 31 per cent to 33 per cent, while the percentage of Internet users went up four percentage points to 82 per cent between 2010 and 2011.

Mobile-broadband penetration rose from 43 per cent in 2010 to 62 per cent in 2011, which represents one of the biggest increases worldwide and places the United Kingdom among the highest ranked countries for this indicator (see Chart Box 2.7). This is explained by a remarkable growth in smartphone uptake in 2011, prompting telecommunication regulator Ofcom to talk of a "smartphone revolution" in the United Kingdom. No fewer than 27 per cent of British adults and 47 per cent of teens[56] own a smartphone. The volume of mobile data transferred over the country's mobile networks increased fortyfold between 2007 and 2010. The surge in data traffic is however not only due to an increase in subscription numbers, but also caused by users downloading increasing amounts of data. In fact, smartphone owners do not only use more data, but text and call more frequently than regular mobile-cellular subscribers. It seems that smartphones, because of their enhanced capabilities and mobility, take on a different role in users' daily activities and social and working lives from that which standard mobile-cellular phones and computers were able to play. Of British adults, 37 per cent admit to being highly addicted to their smartphones, while 60 per cent of teens subscribe to that statement. The revolution will continue, since almost half of phones sold in the first quarter of 2011 were smartphones (Ofcom, 2011a). Furthermore, apart from providing connectivity on the go, a study by Ofcom shows that mobile broadband, in some cases, can be a substitute for, rather than just a complement to, fixed (wired) broadband. Although numbers are (still) relatively low, in 2011 some 7 per cent of British households relied solely on a mobile connection to access the Internet (Ofcom, 2011b).

Chart Box 2.7: Active mobile-broadband subscriptions per 100 inhabitants, United Kingdom in comparison with regional and world average, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

developing countries such as Azerbaijan, Ghana and Saudi Arabia, mobile-broadband penetration was below 10 per cent in 2010, but took off in 2011, climbing to 22, 23 and 40 per cent, respectively. In Fiji, mobile broadband has gradually been extended and massive increases in subscription numbers have been recorded from 2010 to 2011, reaching 16 per cent penetration. Macao (China) stands out with the highest mobile-broadband penetration rate worldwide, followed by Singapore, Republic of Korea and Japan, as well as a number of Northern European countries (Sweden, Finland and Denmark). There are, however, several countries that have not (yet) launched 3G services commercially and have thus seen their use sub-index rank fall; these include Saint Lucia, Barbados, Algeria and Guyana.

Fixed (wired)-broadband penetration remains behind mobile-broadband penetration globally. There are now almost twice as many mobile-broadband than fixed (wired)-broadband

subscriptions. In 50 of the countries included in the IDI, fixed (wired)-broadband penetration is below 1 per cent. Especially in low-income developing and least developed countries, fixed (wired)-broadband uptake is marginal. Few countries have a higher fixed (wired)-broadband than mobile-broadband penetration rate. Notable exceptions include some of the IDI top performers such as Switzerland and Norway, which all boast very high fixed (wired)-broadband penetration rates, but also developing countries such as China, Mexico and Seychelles. A number of Caribbean countries – Barbados, St. Vincent and the Grenadines and Saint Lucia – have not yet launched 3G, but have a considerable number of fixed (wired)-broadband subscriptions (12 to 22 per cent penetration). Growth in fixed (wired)-broadband penetration was observed in Ecuador, where penetration doubled from 2 per cent in 2010 to 4 per cent in 2011, as well as in Azerbaijan and Belarus, where penetration exceeded 10 and 20 per cent, respectively, by end 2011.

One of the biggest increases in the percentage of Internet users can be seen in Bahrain, where 77 per cent of the population are online, up from 55 per cent in 2010. This is also reflected in an increase in both fixed (wired)-broadband and mobile-broadband subscriptions, leading to an impressive leap in the country's use sub-index of 1.40, the highest increase worldwide (see Box 2.1). Belarus is another country where the number of Internet users went up significantly, albeit at lower levels than in Bahrain. In many countries, such as Georgia, Malta, Kazakhstan and Fiji, among others, mobile broadband has been a driver of Internet usage.

It has to be pointed out that the percentage of Internet users does not only refer to those that have a (personal) subscription to an Internet service and access the Internet through broadband networks, but also includes access at narrowband speeds or public Internet access centres. For instance, while in Kenya the number of Internet users increased by 14 percentage points, this is not due to an increase in mobile-broadband or fixed (wired)-broadband penetration numbers, which in fact remain below 1 per cent. As pointed out before, 2/2.5G networks are the most widely used mobile Internet access method (Communications Commission of Kenya, 2011a), and most Kenyans access the Internet from a cybercafé, a community/education centre or at work (Communications Commission of Kenya, 2011b).

Skills sub-index

The three indicators included in the skills sub-index of the IDI are: adult literacy rate, gross secondary enrolment ratio and gross tertiary enrolment ratio. These indicators are used as proxy indicators to help capture each country's level of human capacity and its population's ability to make use of ICTs, in the absence of more targeted indicators, such as ICT literacy. Therefore, the skills sub-index is weighted less in the calculation of the IDI and makes up 20 per cent of the overall IDI, as compared with 40 per cent for each of the two other sub-indices.

Skills sub-index values change only very gradually, in particular in developed countries where very high levels of literacy and enrolment have already been achieved. Furthermore, data are not always available for the latest year. Thus, 2010 and 2011 sub-index values are identical for most countries (see Table 2.10). Nevertheless, the skills sub-index provides a good indication of the overall level of human capacity in a country. This is important because, in addition to ICT infrastructure, education and skills are necessary for making effective use of ICTs and building a competitive and inclusive information society.

2.5 Regional IDI analysis

An analysis of the IDI for each of the six regions[57] highlights differences in ICT development globally and regionally. By looking at the regional level, important development trends can be identified and the reasons why some countries are lagging behind can be pinpointed. European countries generally rank very high in the IDI, with a regional average of 6.49, which is clearly outstanding in international comparison. The CIS region has the second highest regional IDI, at 4.43, closely followed by the Americas, with an average of 4.26. Asia and the Pacific has a relatively low regional average IDI of 4.02, which remains below the global average of 4.15. The Arab States region has the second lowest regional IDI value, at 3.77. African countries are invariably found in the low ranks of the IDI, and the regional average is very low at 1.88. (see Chart 2.7)

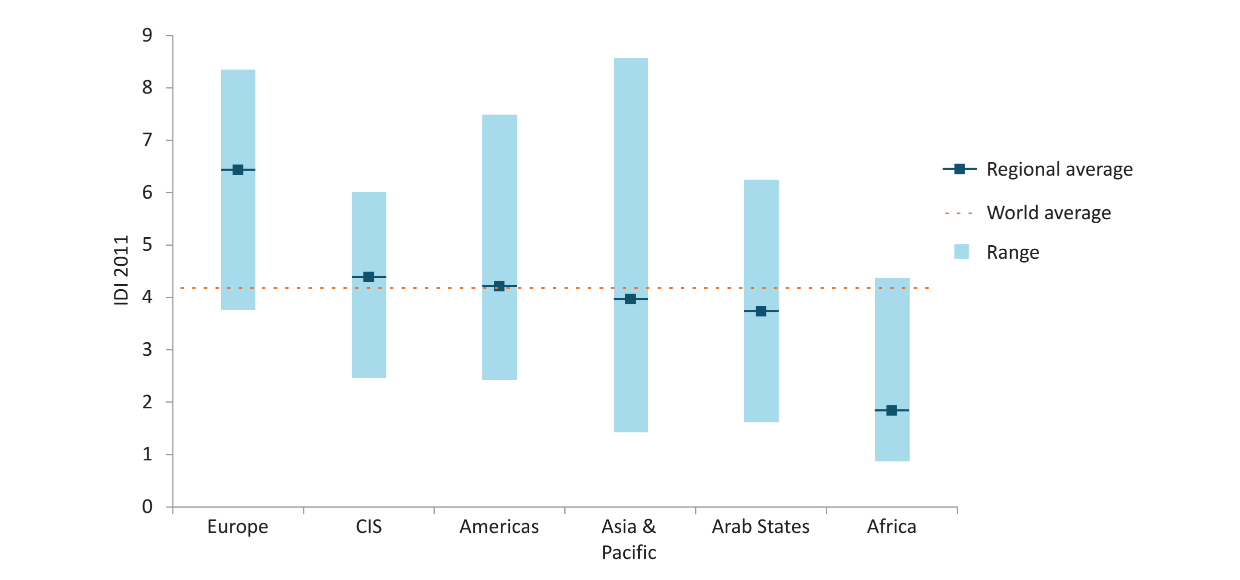
An analysis of regional IDI ranges – calculated by deducting the lowest value from the highest value – and coefficients of

Table 2.10: IDI skills sub-index, 2010 and 2011

Economy	Rank 2011	Skills 2011	Rank 2010	Skills 2010
Korea (Rep.)	1	9.86	1	9.86
Finland	2	9.68	2	9.68
United States	3	9.65	3	9.65
Greece	4	9.54	4	9.54
Cuba	5	9.47	5	9.47
Slovenia	6	9.45	6	9.45
New Zealand	7	9.38	7	9.38
Belarus	8	9.28	8	9.28
Lithuania	9	9.16	9	9.16
Australia	10	9.15	10	9.15
Ukraine	11	9.15	11	9.15
Denmark	12	9.10	12	9.10
Iceland	13	9.09	13	9.09
Norway	14	9.08	14	9.08
Spain	15	9.02	15	9.02
Sweden	16	8.98	16	8.98
Poland	17	8.89	17	8.89
Belgium	18	8.87	18	8.87
Canada	19	8.85	19	8.85
Barbados	20	8.82	20	8.82
Russian Federation	21	8.79	21	8.79
Italy	22	8.79	22	8.79
Estonia	23	8.74	23	8.74
Netherlands	24	8.71	24	8.71
Ireland	25	8.66	25	8.66
Hungary	26	8.64	26	8.64
Austria	27	8.62	27	8.62
Japan	28	8.59	28	8.59
United Kingdom	29	8.58	29	8.58
Argentina	30	8.57	30	8.57
Portugal	31	8.56	31	8.56
Romania	32	8.54	32	8.54
Venezuela	33	8.52	33	8.52
Latvia	34	8.49	34	8.49
France	35	8.44	35	8.44
Israel	36	8.41	36	8.41
Uruguay	37	8.38	37	8.38
Macao, China	38	8.35	38	8.35
Czech Republic	39	8.33	39	8.33
Cyprus	40	8.27	40	8.27
Switzerland	41	8.18	41	8.18
Chile	42	8.18	42	8.18
Germany	43	8.17	43	8.17
Mongolia	44	8.11	44	8.11
Croatia	45	8.10	45	8.10
Slovakia	46	8.08	46	8.08
Bahrain	47	8.08	47	8.08
Hong Kong, China	48	8.05	48	8.05
Kazakhstan	49	8.00	51	7.83
Bulgaria	50	7.97	49	7.97
Serbia	51	7.93	50	7.93
Colombia	52	7.62	52	7.62
Brazil	53	7.53	53	7.53
Malta	54	7.52	54	7.52
Jordan	55	7.50	55	7.50
Lebanon	56	7.49	56	7.49
Moldova	57	7.48	57	7.48
Bosnia and Herzegovina	58	7.43	58	7.43
Saudi Arabia	59	7.42	59	7.42
Albania	60	7.38	60	7.38
Costa Rica	61	7.37	61	7.37
Thailand	62	7.34	64	7.22
TFYR Macedonia	63	7.34	62	7.34
St. Vincent and the G.	64	7.23	63	7.23
Peru	65	7.20	65	7.20
Antigua & Barbuda	66	7.17	66	7.17
Tonga	67	7.17	67	7.17
Turkey	68	7.13	68	7.13
Georgia	69	7.13	69	7.13
United Arab Emirates	70	7.08	70	7.08
Singapore	71	7.08	71	7.08
Brunei Darussalam	72	7.08	72	7.08
Panama	73	7.07	73	7.07
Iran (I.R.)	74	7.04	74	7.04
Oman	75	7.03	75	7.03
Bolivia	76	6.98	76	6.98
Philippines	77	6.96	78	6.96
Uzbekistan	78	6.93	77	6.97
Jamaica	79	6.93	79	6.93
Mexico	80	6.91	80	6.91
Luxembourg	81	6.90	81	6.90
Saint Lucia	82	6.87	82	6.87
Turkmenistan	83	6.87	83	6.87
Ecuador	84	6.81	84	6.81
Azerbaijan	85	6.77	85	6.77
Tunisia	86	6.74	86	6.74
Mauritius	87	6.73	87	6.73
Guyana	88	6.72	88	6.72
China	89	6.70	89	6.70
Malaysia	90	6.69	90	6.69
Trinidad & Tobago	91	6.67	91	6.67
Dominican Rep.	92	6.62	92	6.62
Qatar	93	6.61	93	6.61
South Africa	94	6.61	94	6.61
Algeria	95	6.60	95	6.60
Paraguay	96	6.60	96	6.60
Fiji	97	6.59	97	6.59
Sri Lanka	98	6.45	98	6.45
Seychelles	99	6.45	99	6.45
Indonesia	100	6.41	100	6.41
Viet Nam	101	6.40	101	6.40
Maldives	102	6.34	102	6.34
Cape Verde	103	6.33	103	6.33
Egypt	104	5.90	104	5.90
Honduras	105	5.86	105	5.86
El Salvador	106	5.75	106	5.75
Syria	107	5.74	107	5.74
Botswana	108	5.71	108	5.71
Nicaragua	109	5.56	109	5.56
Namibia	110	5.38	110	5.38
Myanmar	111	5.24	111	5.24
Gabon	112	5.08	112	5.08
Kenya	113	5.04	113	5.04
Swaziland	114	4.98	114	4.98
India	115	4.63	115	4.63
Zimbabwe	116	4.63	116	4.63
Solomon Islands	117	4.45	118	4.45
Tuvalu	117	4.45	118	4.45
Ghana	119	4.45	117	4.48
Cambodia	120	4.38	120	4.38
Lao P.D.R.	121	4.35	121	4.35
Comoros	122	4.28	122	4.28
Morocco	123	4.18	123	4.18
Cameroon	124	4.14	124	4.14
Bhutan	125	4.11	125	4.05
Zambia	126	3.96	126	3.96
Yemen	127	3.89	127	3.89
Nigeria	128	3.83	128	3.83
Djibouti	129	3.80	134	3.55
Nepal	130	3.76	129	3.76
Congo (Dem. Rep.)	131	3.69	130	3.69
Congo (Rep. of the)	132	3.66	131	3.66
Rwanda	133	3.61	132	3.61
Togo	134	3.61	133	3.61
Malawi	135	3.55	135	3.55
Gambia	136	3.49	136	3.49
Uganda	137	3.45	137	3.45
Tanzania	138	3.41	138	3.41
Eritrea	139	3.35	139	3.35
Madagascar	140	3.31	140	3.31
Papua New Guinea	141	3.27	141	3.27
Pakistan	142	3.17	142	3.17
Senegal	143	3.16	143	3.16
Côte d'Ivoire	144	3.13	144	3.13
Liberia	145	2.93	145	2.93
Guinea	146	2.90	146	2.90
Mauritania	147	2.87	147	2.87
Benin	148	2.82	148	2.82
Mozambique	149	2.73	149	2.73
Mali	150	2.38	152	2.32
Ethiopia	151	2.36	150	2.36
Central African Rep.	152	2.34	151	2.34
Chad	153	2.05	153	2.05
Burkina Faso	154	1.82	154	1.76
Niger	155	1.45	155	1.45

Source: ITU.

Chart 2.7: IDI ranges and averages, by region, 2011



Source: ITU.
Note: Simple averages.

variation[58] provide additional insights into differences in ICT level within each region (see Table 2.11). By far the biggest range (7.12) can be seen in the Asia and the Pacific region, which is not only home to the country with the highest IDI (Republic of Korea), but also countries with some of the lowest IDI values (e.g. Papua New Guinea). The coefficient of variation is highest in this region, which reflects the great diversity within the region and illustrates the regional divide in terms of ICT development. The picture is similar in the Americas and the Arab States, although the regional ranges in the Americas (5.04) and the Arab States (4.59) are somewhat smaller than in the Asia and the Pacific region. Average regional IDI values are similar in the Americas and the CIS, while the latter has the smaller range (3.51). The CIS region has the second lowest coefficient of variation value (after Europe), which shows that countries are at a

Table 2.11: IDI by region, 2010 and 2011

Region	IDI 2011						IDI 2010						Difference 2010-2011		
	Max.	Min.	Range	Average value*	SD	CV	Max.	Min.	Range	Average value*	SD	CV	Range	Average value*	CV
Europe	8.34	3.78	4.56	6.49	1.15	17.72	8.21	3.48	4.74	6.26	1.16	18.53	-0.18	0.23	-0.81
CIS	6.00	2.49	3.51	4.43	1.13	25.51	5.61	2.44	3.16	4.06	1.02	25.12	0.34	0.37	0.38
The Americas	7.48	2.44	5.04	4.26	1.28	30.05	7.11	2.31	4.80	4.04	1.22	30.20	0.24	0.22	-0.15
Asia & Pacific	8.56	1.44	7.12	4.02	2.24	55.72	8.45	1.36	7.10	3.83	2.21	57.70	0.02	0.19	-1.98
Arab States	6.24	1.64	4.59	3.77	1.57	41.64	5.94	1.53	4.41	3.52	1.44	40.91	0.18	0.25	0.74
Africa	4.37	0.88	3.49	1.88	0.83	44.15	4.00	0.88	3.12	1.75	0.76	43.43	0.37	0.13	0.72

Source: ITU.
Note: * Simple average. SD = Standard deviation; CV = Coefficient of variation.

Table 2.12: The top five economies in each region and their ranking in the global IDI, 2011

Regional IDI rank	Europe	Global IDI rank	Asia & Pacific	Global IDI rank	The Americas	Global IDI rank	Arab States	Global IDI rank	CIS	Global IDI rank	Africa	Global IDI rank
1	Sweden	2	Korea (Rep.)	1	United States	15	Qatar	30	Russian Fed.	38	Seychelles	70
2	Denmark	3	Japan	8	Canada	22	Bahrain	40	Belarus	46	Mauritius	74
3	Iceland	4	Hong Kong, China	11	Barbados	34	UAE	45	Kazakhstan	49	South Africa	91
4	Finland	5	Singapore	12	Antigua & Barbuda	43	Saudi Arabia	47	Moldova	62	Cape Verde	101
5	Netherlands	6	Macao, China	14	Uruguay	50	Oman	53	Ukraine	67	Botswana	108

Source: ITU.

more similar stage in terms of ICT development, although both the coefficient of variation and the range have in fact increased between 2010 and 2011.

Europe is the region with by far the lowest coefficient of variation, and the only region where the range of IDI values decreased from 2010 to 2011. This confirms that European countries are becoming more homogenous in terms of ICT development, and that the regional divide is narrowing. Africa is the region with the smallest range (3.49), but it has the second highest coefficient of variation, which underlines that there are major differences in terms of ICT development within the region. Furthermore, both these values increased from 2010 to 2011. While the lowest ranked country (Niger) was unable to improve its IDI, the highest ranked country (Seychelles) made significant progress. In this regard, Africa is the exception: in other regions with increases in IDI range, both the top- and bottom-ranked countries improved their performance, with the top countries usually moving at a faster pace. The coefficient of variation also increased in the Arab States, CIS and Africa, indicating that regional differences are widening. This is a rather alarming trend, which suggests that the digital divide, both globally and regionally, is widening.

A comparison of the global and regional rankings of the top five countries in each region illustrates the global divide in ICT development, as well as regional imbalances (see Table 2.12):

- Europe is the region with the smallest differences in the top five, and global and regional ranks are almost identical.
- For the top five countries, differences in global and regional ranks are also small in the Asia and the Pacific region, and the regional top five all feature in the global top 15.
- The United States and Canada, the only two developed countries in the Americas region, stand apart from other countries in the region and rank very high globally.
- The top five countries in the Arab States region rank closely together, in the upper-medium segment of the IDI.
- The picture is similar in the CIS, where the top five countries rank quite closely together, although lower down than the Arab States' top five.
- In Africa, Seychelles and Mauritius stand out with a relatively high global ranking, whereas most countries in the region rank well down in the IDI.

Africa

Africa remains the region with the lowest average IDI (1.88), less than half the global average (4.15). In the IDI 2011, African countries rank between 70th (Seychelles) and 155th (Niger). Seychelles and Mauritius have IDI values above four, followed by South Africa and Cape Verde with IDI values above three. However, 26 out of 36 countries in the region have IDI values below two,

including three countries with IDI values below one (see Table 2.13).

Some progress has been made between 2010 and 2011, however, and the regional average IDI increased from 1.75 to 1.88. Furthermore, a number of African countries are among the most dynamic, and impressive improvements took place in Kenya, Zimbabwe, Rwanda and Ghana. In Ghana, mobile-broadband penetration improved sharply (see Box 2.3), while in Kenya the number of Internet users doubled from 2010 to 2011. Zimbabwe progressed in both the access and use sub-indices, mostly by expanding mobile-broadband penetration and international Internet bandwidth. Rwanda rose seven places in the global rankings, although the country still ranks low, not only globally (133rd), but even within the region.

On the other hand, Niger is the only country worldwide where the IDI value did not improve, and it has thus fallen behind Chad, taking last place in the global IDI. The country's access sub-index fell, owing to a decrease in international Internet bandwidth per Internet user. Furthermore, Niger's use sub-index remains very low (0.04) and shows only a very modest growth from 2010 to 2011. Mobile broadband is not yet available in the country and fixed (wired)-broadband penetration remains negligible (0.01 per cent).

Table 2.13: IDI – Africa

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
Seychelles	1	70	4.37	69	4.00	-1
Mauritius	2	74	4.18	70	3.95	-4
South Africa	3	91	3.42	90	3.20	-1
Cape Verde	4	101	3.08	101	2.90	0
Botswana	5	108	2.67	108	2.50	0
Namibia	6	109	2.51	112	2.27	3
Gabon	7	111	2.47	110	2.40	-1
Kenya	8	114	2.32	114	2.07	0
Zimbabwe	9	115	2.24	118	1.89	3
Swaziland	10	116	2.24	115	2.06	-1
Ghana	11	117	2.23	121	1.81	4
Nigeria	12	122	1.93	124	1.75	2
Senegal	13	124	1.85	122	1.76	-2
Gambia	14	125	1.84	123	1.75	-2
Côte d'Ivoire	15	129	1.69	131	1.62	2
Uganda	16	132	1.67	136	1.53	4
Rwanda	17	133	1.66	140	1.50	7
Togo	18	134	1.65	132	1.59	-2
Zambia	19	135	1.65	137	1.53	2
Cameroon	20	138	1.60	135	1.54	-3
Tanzania	21	139	1.60	139	1.52	0
Congo (Rep. of the)	22	140	1.60	133	1.55	-7
Benin	23	141	1.55	141	1.49	0
Madagascar	24	143	1.44	142	1.41	-1
Malawi	25	144	1.42	143	1.37	-1
Mali	26	145	1.38	147	1.24	2
Congo (Dem. Rep.)	27	146	1.30	149	1.18	3
Mozambique	28	147	1.28	145	1.26	-2
Guinea	29	148	1.28	146	1.25	-2
Liberia	30	149	1.26	148	1.20	-1
Ethiopia	31	150	1.15	150	1.09	0
Burkina Faso	32	151	1.14	152	1.06	1
Eritrea	33	152	1.09	151	1.08	-1
Central African Rep.	34	153	0.97	153	0.96	0
Chad	35	154	0.94	155	0.85	1
Niger	36	155	0.88	154	0.88	-1
Average			1.88		1.75	

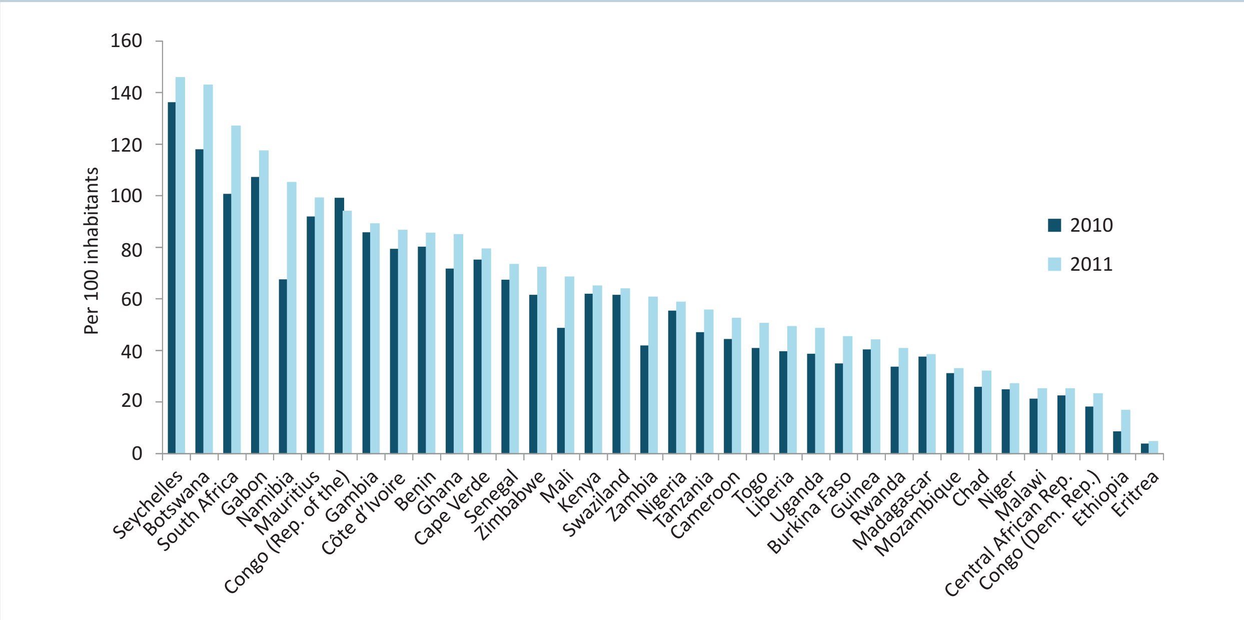
Source: ITU.
Note: Simple average.

The Republic of the Congo is the African country registering the biggest drop in IDI ranking in 2011. This indicates that, despite showing modest improvements in both the access and use sub-indices, it could not keep up with the pace of ICT development in other countries. For example, whereas mobile-broadband penetration is an important growth factor in many African countries, 3G was only launched in the Republic of the Congo in late 2011. Thus, penetration remains marginal, at around 1 per cent, though it is expected to increase once people get acquainted with the service and a larger proportion of the population start using it.

The African regional access sub-index is not only higher than the region's use sub-index, but shows stronger average growth. This points to the general low level of ICT development in the region, and the fact that many basic infrastructure needs have yet to be met. As has been pointed out earlier, many African countries are among those that have made most progress globally in the access sub-index. Impressive growth continues in mobile-cellular subscriptions, which have reached very high penetration levels in a number of African countries (see Chart 2.8). Significant increases occurred in Namibia,[59] South Africa and Botswana, where penetration exceeds 100 per cent. Mali and Zambia show impressive growth rates as well, though both countries remain below 70 per cent penetration. Household ICT access is still quite low: in 13 (out of 36) African countries, only 2 per cent or less of households have Internet access. However, progress in ICT household access has been made in the region's top performing countries, Seychelles and Mauritius, where penetration rates increased by over seven percentage points.

The IDI use sub-index remains very low in Africa, with a regional average of 0.50. Mobile-broadband services play an important role in the region, and have the potential to drive ICT developments in the continent. It is no surprise that, in the most dynamic African countries, including Ghana, Zimbabwe and Rwanda, growth in mobile-broadband penetration had a major impact in terms of improving their IDI scores. Ghana now has the highest mobile-broadband penetration rate in the region, at 23 per cent, which is comparable to that of many developed countries (see Box 2.3). However, 12 out of 36 African countries have not yet launched 3G commercially.

Chart 2.8: Mobile-cellular telephone subscriptions per 100 inhabitants, Africa, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

While significant improvements were made in terms of extending mobile-broadband penetration, fixed (wired)-broadband penetration is marginal in a large number of African countries. In 15 out of 36 African nations, fixed (wired)-broadband penetration was below 1 per cent in 2011. Furthermore, no significant growth occurred from 2010 to 2011, with the exception of Mauritius and Seychelles, where penetration progressed, although only modestly by two to three percentage points. Both countries recorded increases in the use sub-index which are above the global average increase. Moreover, Ghana and Kenya stand out for their relatively high use sub-index values and increases, the latter having achieved a growth many times the regional and global averages. Also, in both countries the use sub-index increased more than the access sub-index between 2010 and 2011.

Arab States

The Arab States' IDI ranking closely matches differences in income levels across the region. The top five countries with the highest IDI values in the region are all part of the Gulf Cooperation Council (GCC). All of these countries have an IDI of above five, Qatar standing out with an IDI of above six. While Lebanon (see Box 2.6) keeps up well with the region's high-income countries in terms of ICT development (with an IDI of 4.48), all remaining countries of the Arab States region are below the global IDI average of 4.15. Yemen, Djibouti, Comoros and Mauritania lie at the bottom of the regional ranking, with IDI values of less than two (see Table 2.14).

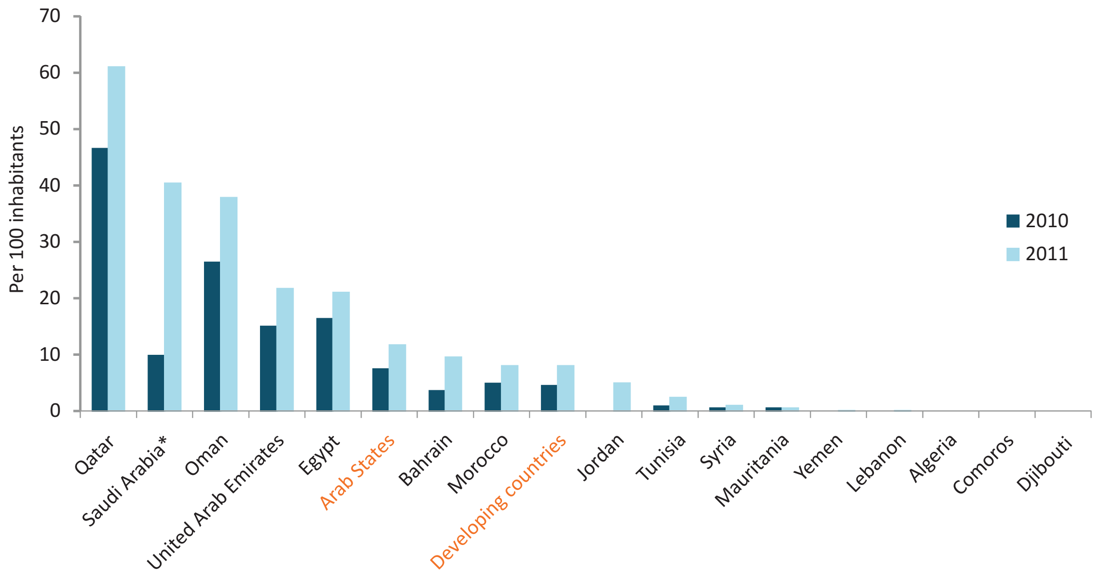
The countries at the top of the regional ranking (i.e. the regional top five) made much more significant progress in the use sub-index than in the access sub-index, whereas, conversely, those ranked at the bottom progressed very little in terms of use, but improved their access sub-index scores. Bahrain (see Box 2.1) and Saudi Arabia recorded the highest use sub-index increases globally, while Lebanon, Morocco and Mauritania are among the most dynamic countries for the access sub-index. This underlines that high-income GCC countries have arrived at a more advanced stage of ICT development. In Bahrain and Saudi Arabia, for instance, now that ICT infrastructure and access is already widespread, these countries are henceforth increasing their ICT usage and entering the next stage of ICT development. In contrast, Mauritania, which has a use sub-index of less than 0.20, and Morocco and Lebanon, despite having a higher use sub-index of around two, still clearly require ICT-infrastructure improvements before they can fully leverage ICTs to increase intensity of use and exert a wider impact on society. Impressive improvements in the countries' access sub-indices, however, offer promising signs that Lebanon,

Table 2.14: IDI – Arab States

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
Qatar	1	30	6.24	31	5.94	1
Bahrain	2	40	5.85	45	5.19	5
United Arab Emirates	3	45	5.64	43	5.41	-2
Saudi Arabia	4	47	5.43	53	4.81	6
Oman	5	53	5.10	54	4.75	1
Lebanon	6	65	4.48	68	4.11	3
Jordan	7	75	3.95	77	3.61	2
Egypt	8	83	3.66	81	3.44	-2
Tunisia	9	85	3.58	83	3.42	-2
Morocco	10	90	3.46	92	3.19	2
Syria	11	96	3.15	96	3.01	0
Algeria	12	104	2.98	103	2.86	-1
Yemen	13	126	1.76	126	1.70	0
Djibouti	14	128	1.74	128	1.65	0
Comoros	15	130	1.68	130	1.64	0
Mauritania	16	136	1.64	138	1.53	2
Average			3.77		3.52	

Source: ITU.
Note: Simple average.

Chart 2.9: Active mobile-broadband penetration, Arab States, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.
Note: * Break in comparability between 2010 and 2011 data.

Morocco and, to a lesser extent Mauritania, are all making progress towards becoming information societies.

Mobile-cellular telephony is one of the most dynamic ICT services in the region, its regional average penetration rate having increased from 88 per cent in 2010 to 97 per cent in 2011. In 2011, mobile-cellular penetration was over 100 per cent in more than half of Arab countries included in the IDI. Further advances were made with regard to household ICT access, foremost in Lebanon where both the number of households with a computer and households with Internet access increased by ten percentage points. Regional frontrunners Bahrain, Qatar and the United Arab Emirates also enjoy very high ICT household access rates. In Qatar, for example, 88 per cent of households have a computer and 84 have access to the Internet, which is more than twice the global average.

Mobile-broadband penetration has risen significantly in a number of Arab countries (such as Oman, Saudi Arabia and Qatar) and is well above the developing-country average (see Chart 2.9). Qatar, the regional number one, stands out with the highest mobile-broadband penetration rate in the region (61 per cent), comparable with that of top performers in the IDI. Many new subscriptions were added in Qatar in 2011, and this is also the case for Oman and Saudi Arabia, where mobile-broadband penetration has now climbed to 38 and 40 per cent, respectively. Lebanon, Jordan and Yemen introduced 3G in 2011 and, with the exceptions of Algeria, Djibouti and Comoros, all countries in the region had launched 3G by 2011.

While mobile broadband is growing in the Arab States region, fixed (wired)-broadband penetration lags somewhat behind, and is lower on average than in the rest of the world (with the exception of Africa).[60] Few Arab countries show significant increases in fixed (wired)-broadband penetration from 2010 to 2011. A notable exception is Bahrain, where fixed (wired)-broadband penetration increased from 5 per cent in 2010 to 14 per cent in 2011, which even outstrips the country's mobile-broadband penetration rate. Bahrain has the highest fixed (wired)-broadband penetration in the region, followed by the United Arab Emirates (11 per cent), Qatar (9 per cent) and Saudi Arabia (6 per cent).

Bahrain also stands out for increases in Internet usage. The percentage of the Bahraini population using the Internet

increased from 55 per cent in 2010 to 77 per cent in 2011, the second highest Internet user penetration rate in the region, only surpassed by Qatar. Other countries recording impressive progress in the number of Internet users include Saudi Arabia and Oman, as well as Jordan.

Asia and the Pacific

The Asia and the Pacific region includes some of the world's top IDI performers: first and foremost, the Republic of Korea, followed by Japan and Hong Kong (China) (see Box 2.5). The top seven in the regional ranking display a similarly high level of ICT development, with IDI values of over seven, and are the only countries from the region to rank in the top 50 globally. There is a big gap between Australia (in 7th place), with an IDI of 7.05, and Brunei Darussalam (in 8th place), with an IDI of 4.95. Further down the list, the regional divide becomes even more severe. Out of 30 countries in the Asia and the Pacific region included in the IDI, 11 have a value of less than three. Papua New Guinea ranks last regionally and 142nd globally, with an IDI of just 1.44 (see Table 2.15). As mentioned before, the Asia and the Pacific region has the biggest range in IDI values, which confirms the diversity of countries in this region and their different levels of (ICT) development.

Viet Nam and Fiji are the countries from the region that made most progress between 2010 and 2011. Both of them improved their global IDI ranking by five places, and they increased their IDI scores by 0.27 and 0.42, respectively (in comparison with an average increase of 0.21 globally). Increases in the use sub-index are the main factor in this

Table 2.15: IDI – Asia and the Pacific

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
Korea (Rep.)	1	1	8.56	1	8.45	0
Japan	2	8	7.76	8	7.57	0
Hong Kong, China	3	11	7.68	12	7.39	1
Singapore	4	12	7.66	10	7.47	-2
Macao, China	5	14	7.51	13	7.38	-1
New Zealand	6	17	7.34	18	7.03	1
Australia	7	21	7.05	21	6.75	0
Brunei Darussalam	8	57	4.95	52	4.85	-5
Malaysia	9	58	4.82	57	4.63	-1
Maldives	10	72	4.30	72	3.92	0
China	11	78	3.88	79	3.58	1
Viet Nam	12	81	3.68	86	3.41	5
Mongolia	13	84	3.63	87	3.36	3
Iran (I.R.)	14	87	3.53	88	3.35	1
Fiji	15	88	3.50	93	3.08	5
Thailand	16	92	3.41	89	3.29	-3
Philippines	17	94	3.19	94	3.04	0
Indonesia	18	95	3.19	97	3.01	2
Tonga	19	100	3.12	98	2.94	-2
Sri Lanka	20	105	2.88	105	2.74	0
Tuvalu	21	112	2.46	113	2.23	1
Bhutan	22	118	2.13	117	1.92	-1
India	23	119	2.10	116	1.98	-3
Lao P.D.R.	24	120	1.99	120	1.84	0
Cambodia	25	121	1.96	119	1.88	-2
Solomon Islands	26	123	1.85	127	1.67	4
Pakistan	27	127	1.75	125	1.71	-2
Myanmar	28	131	1.67	129	1.65	-2
Nepal	29	137	1.63	134	1.55	-3
Papua New Guinea	30	142	1.44	144	1.36	2
Average			4.02		3.83	

Source: ITU.
Note: Simple average.

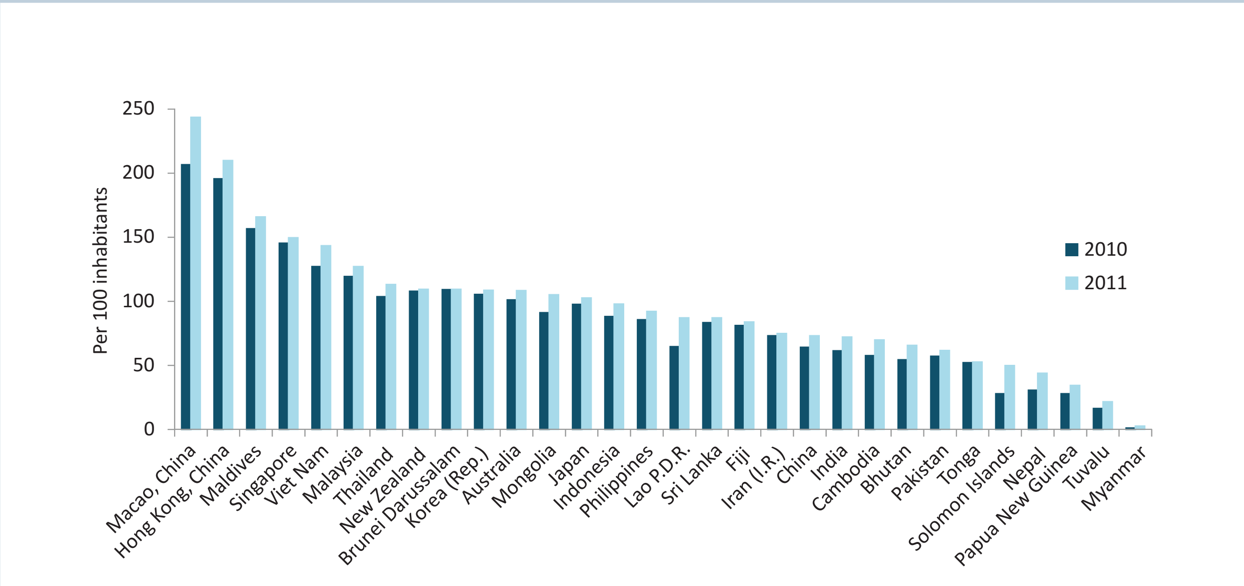
overall progress, and Fiji is also one of the most dynamic countries worldwide in terms of the use sub-index, along with Maldives and Cambodia. In all four countries, mobile-broadband penetration and the percentage of Internet users grew significantly from 2010 to 2011.

None of the countries from the Asia and the Pacific region stand out in terms of increases in the access sub-index from 2010 to 2011, despite the fact that, out of the 30 countries in the region included in the IDI, 19 have access sub-index values below the global average of 4.66, and many well below that number. This indicates that countries from the Asia and the Pacific region with a lower IDI value are making little progress in developing their ICT infrastructure, and are falling further behind in regional and international comparison. Myanmar, for instance, has a very low access sub-index of 1.52, which increased by a mere 0.03 points between 2010 and 2011. Likewise, India and Pakistan have very low access sub-index values of 2.48 and 2.46, respectively, and recorded very little, below-average, growth from 2010 to 2011. At the same time, economies ranked at the top are consolidating their positions in the access sub-index, and a number of them – New Zealand, Australia, Maldives and Hong Kong (China) – are making impressive strides in the use sub-index.

Mobile-cellular penetration is the most dynamic indicator in the access sub-index, but penetration rates reflect the diverse stages of (ICT) development in the region (see Chart 2.10). While Macao (China) and Hong Kong (China) have the two highest penetration rates worldwide, a number of countries, including Lao P.D.R., Nepal and the small island states Solomon Islands and Tuvalu, are far from reaching saturation levels, despite having improved considerably from 2010 to 2011. The number of households with Internet access is highest worldwide in the Republic of Korea, with an impressive 97 per cent of households connected. In the region's LDCs (with the exceptions of Bhutan and Tuvalu), however, penetration stood at less than 4.5 per cent by end 2011. China and the Philippines show significant growth in terms of household Internet access, reaching 31 and 15 per cent penetration, respectively, by end 2011.

In the use sub-index, top performers in the Asia and the Pacific region excel with some of the most impressive broadband penetration rates worldwide. In most low- and middle-income countries in the region, however, fixed (wired)-broadband penetration remains marginal. China is a notable exception, with a penetration rate of 12 per cent, which even outstrips the country's mobile-broadband

Chart 2.10: Mobile-cellular telephone penetration in the Asia and the Pacific region, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

penetration rate. Four economies from the region – Macao (China), Singapore, Republic of Korea and Japan – enjoy the highest mobile-broadband penetration rates in the world. All of these economies also have a high proportion of Internet users. By contrast, mobile-broadband penetration rates remain very low in the region's low- and middle-income countries. Four countries[61] have not yet launched 3G services, and penetration rates still languish at below 2 per cent in several other countries, including India. Those countries have seen their global rank fall. However, some countries saw significant increases: mobile-broadband penetration tripled in China, to 9 per cent, and doubled in Viet Nam and Maldives, to 18 and 17 per cent, respectively. In Mongolia, penetration increased from 7 per cent in 2010 to 13 per cent in 2011.

Commonwealth of Independent States (CIS)

The Russian Federation lies at the top of the regional ranking, with an IDI of 6.0, followed by Belarus (5.57) and Kazakhstan (5.27). Uzbekistan and Turkmenistan rank last in the region and quite low globally (see Table 2.16).

Between 2010 and 2011, the CIS region has generally made good progress in terms of ICT development, and is the region with the highest average IDI increases (see Table 2.11). Only two countries (Ukraine and Turkmenistan) fell slightly in the global IDI ranking. Furthermore, a number of countries from the region feature among those that made most progress in the IDI from 2010 to 2011. Kazakhstan, Azerbaijan, Belarus and Georgia all improved their overall IDI significantly. Kazakhstan stands out in the region, with the highest increase in IDI of 0.61, almost three times the average change of 0.21. While Kazakhstan, Azerbaijan, Belarus and Georgia all registered impressive and above-average advances in their access sub-index, the increases in their use sub-index are remarkable and explain the improvements they have achieved in the overall IDI.

This progress in ICT usage suggests that Kazakhstan, Azerbaijan, Belarus and Georgia are moving from the first stage of ICT development (ICT readiness) to stage two (ICT intensity). Belarus and Kazakhstan have relatively high access sub-index values of around six, which is considerably higher than the global access sub-index average of 4.66. Azerbaijan and Georgia, however, remain just below the global average, which underlines that more advances in ICT infrastructure are needed to foster sustainable ICT development. Household ICT access in particular is relatively low in both these countries.

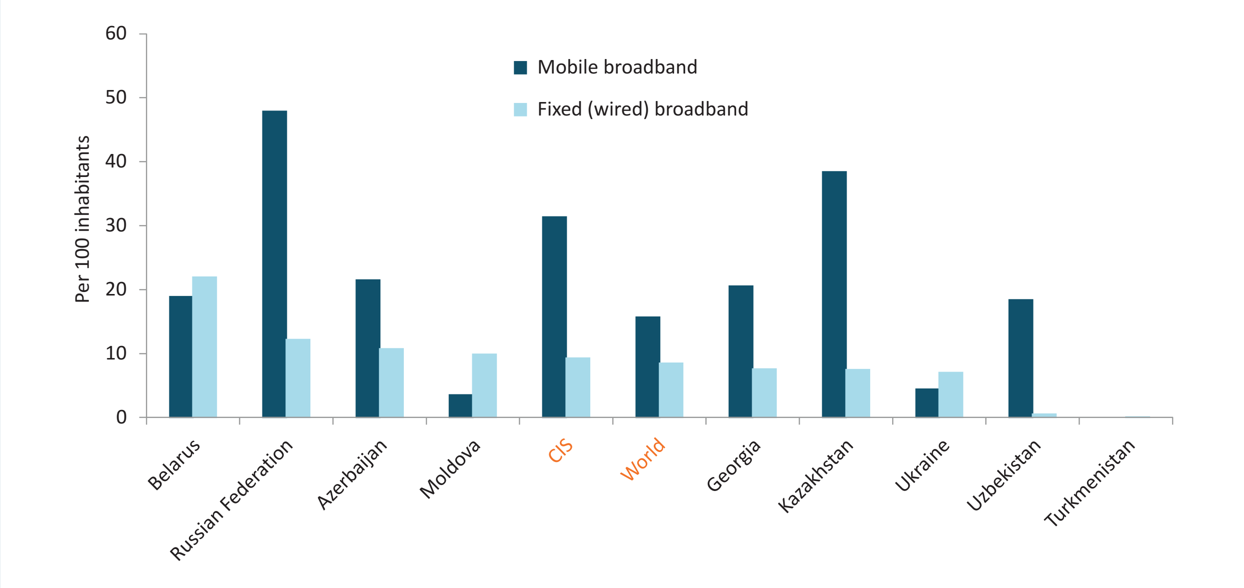
The CIS region boasts the highest average mobile-cellular penetration globally, at 143 subscriptions per 100 inhabitants, which compares favourably even with Europe, where the figure is 120 subscriptions per 100 inhabitants. The Russian Federation, the regional frontrunner, has one of the highest penetration rates worldwide, at 179 per cent by end 2011. With the exception of the two bottom-ranked countries (Turkmenistan and Uzbekistan), all CIS countries exceeded 100 per cent mobile-cellular penetration by end 2011. This helps to explain why growth was stronger in the

Table 2.16: IDI – CIS

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
Russian Federation	1	38	6.00	40	5.61	2
Belarus	2	46	5.57	46	5.08	0
Kazakhstan	3	49	5.27	56	4.65	7
Moldova	4	62	4.55	62	4.24	0
Ukraine	5	67	4.40	65	4.20	-2
Azerbaijan	6	68	4.39	73	3.83	5
Georgia	7	73	4.20	75	3.75	2
Uzbekistan	8	102	3.05	104	2.77	2
Turkmenistan	9	110	2.49	109	2.44	-1
Average			4.43		4.06	

Source: ITU.
Note: Simple average.

Chart 2.11: Fixed (wired)-broadband and active mobile-broadband penetration, CIS region, 2011



Source: ITU World Telecommunication/ICT Indicators database.

use sub-index than in the access sub-index, since mobile-cellular penetration saturation levels had been reached in most CIS countries.

The percentage of households with Internet access varies considerably across the region, with Kazakhstan and Russian Federation attaining the highest penetrations by end 2011 – 48 and 46 per cent, respectively. This contrasts with the very low numbers of households connected to the Internet in Turkmenistan and Uzbekistan – only 6 and 8 per cent, respectively. Belarus is catching up, having increased the proportion of households connected to the Internet from 31 per cent in 2010 to 40 per cent in 2011.

Broadband uptake (both fixed and mobile) was quite strong in a number of CIS countries in 2011, and has exerted a significant impact on countries' performance on the use sub-index. For example, mobile-broadband penetration showed impressive growth rates in Azerbaijan, Kazakhstan and Belarus. Fixed (wired)-broadband penetration is highest in Belarus, where it reaches 22 per cent, a rate comparable with that of many European countries. Furthermore, impressive growth in penetration occurred in a number of countries, including Azerbaijan, where it doubled to reach 11 per cent by end 2011. Turkmenistan and Uzbekistan are the only two countries in the region with negligible fixed (wired)-broadband penetration rates of 0.5 per cent or less (see Chart 2.11). Furthermore, Turkmenistan is the only country in the CIS region that has not yet launched a 3G network commercially. This partly explains why Turkmenistan ranks last regionally and has not been able to make any significant progress from 2010 to 2011.

Europe

Europe is the region with the highest regional average IDI, and includes a large number of countries that are very high up in the IDI rankings (see Chart 2.7). Eight European countries can be found in the top ten in the IDI, and 31 (out of total of 37 European countries included in the IDI) are in the top 50. The regional ranking is headed by the Nordic countries Sweden, Denmark, Iceland and Finland, which all boast an IDI of above eight. The bottom of the list is made up of Southern and Eastern European countries, with Albania ranking last regionally (see Table 2.17).

Although the range in IDI value across the region is still quite high, at 4.56 in 2011, it decreased in relation to 2010, as did the coefficient of variation. This indicates that countries are moving at similar speeds, and that the regional digital divide

Table 2.17: IDI – Europe

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
Sweden	1	2	8.34	2	8.21	0
Denmark	2	3	8.29	3	8.01	0
Iceland	3	4	8.17	4	7.96	0
Finland	4	5	8.04	5	7.89	0
Netherlands	5	6	7.82	7	7.60	1
Luxembourg	6	7	7.76	6	7.64	-1
United Kingdom	7	9	7.75	14	7.35	5
Switzerland	8	10	7.68	9	7.48	-1
Norway	9	13	7.52	11	7.39	-2
Germany	10	16	7.39	15	7.18	-1
France	11	18	7.30	17	7.08	-1
Austria	12	19	7.10	22	6.74	3
Ireland	13	20	7.09	19	6.99	-1
Belgium	14	23	6.89	23	6.60	0
Estonia	15	24	6.81	26	6.36	2
Slovenia	16	25	6.70	24	6.54	-1
Malta	17	26	6.69	28	6.30	2
Israel	18	27	6.62	25	6.41	-2
Spain	19	28	6.62	27	6.31	-1
Italy	20	29	6.28	29	6.13	0
Poland	21	31	6.19	30	6.09	-1
Czech Republic	22	32	6.17	33	5.89	1
Greece	23	33	6.14	35	5.88	2
Lithuania	24	35	6.06	34	5.88	-1
Latvia	25	36	6.06	37	5.80	1
Portugal	26	37	6.05	36	5.86	-1
Slovakia	27	39	5.86	39	5.63	0
Hungary	28	41	5.77	42	5.53	1
Croatia	29	42	5.75	41	5.54	-1
Cyprus	30	44	5.73	38	5.64	-6
Serbia	31	48	5.40	47	5.04	-1
Bulgaria	32	51	5.20	51	4.87	0
Romania	33	52	5.13	50	4.89	-2
TFYR Macedonia	34	54	5.05	48	4.90	-6
Bosnia and Herzegovina	35	63	4.53	64	4.21	1
Turkey	36	69	4.38	66	4.17	-3
Albania	37	80	3.78	80	3.48	0
Average			6.49		6.26	

Source: ITU.
Note: Simple average.

is narrowing. The generally high level of development and income that is predominant in European countries, as well as common EU policies for the ICT sector and harmonized telecommunication regulations, help to explain the relatively high and similar levels of ICT development within the region. The EU's Digital Agenda, part of the Europe 2020 economic development strategy, has set a number of ambitious goals to be achieved by the Union's member states (European Commission, 2010). Emphasis is placed on high-speed broadband connections (30 Mbit/s and above) for all Europeans, increasing the number of people using e-government services, buying products online and across borders and bringing disadvantaged populations online.[62] The European Commission is currently negotiating a proposal under the Connecting Europe Facility (CEF) to facilitate investments in pan-European projects for broadband infrastructure, a step that could further improve ICT infrastructure and connectivity across the region (European Commission, 2011a).

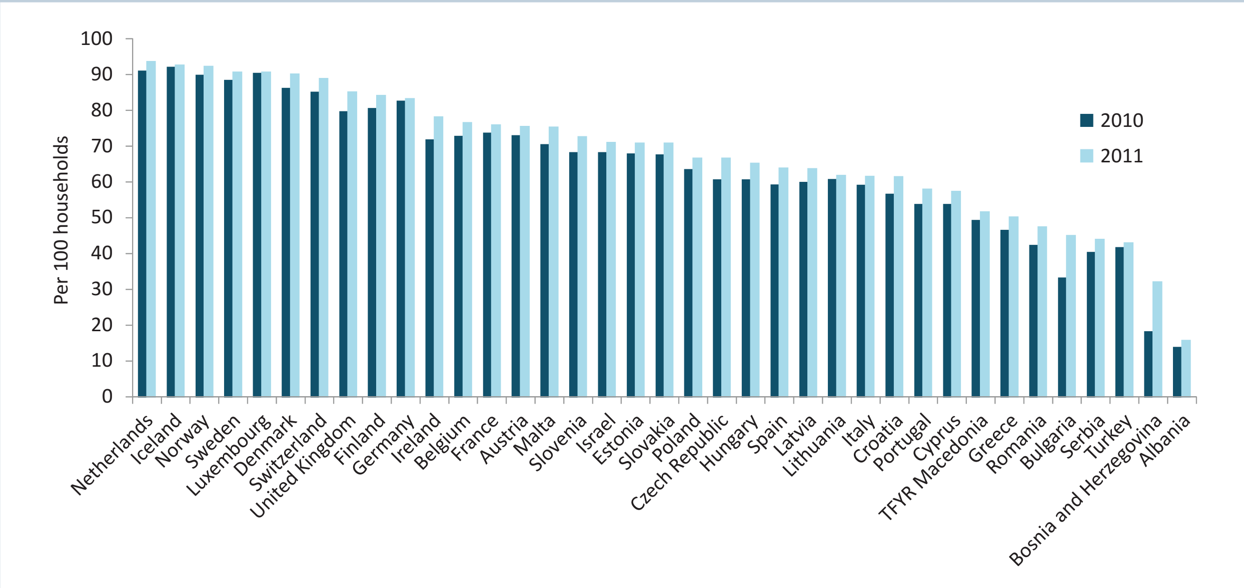
Two EU countries, the United Kingdom (see Box 2.7) and Estonia, are among the countries that progressed the most

in terms of ICT development from 2010 to 2011. Austria is one of the countries that made most progress in the use sub-index. All three countries stand out for significant increases in ICT usage, and in particular mobile-broadband penetration. In general, there is a clear shift to be seen in the region from growth in the access sub-index to growth in the use sub-index. Only four countries (TFYR Macedonia, Cyprus, Poland and Ireland) show stronger increases in the access sub-index than the use sub-index from 2010 to 2011. This is explained by the generally high level of ICT development in Europe, and the fact that most countries have already attained high levels of ICT readiness.

For instance, on average, 75 per cent of European households have a computer and 72 per cent have access to the Internet (see Chart 2.12 and Chart 2.13). In seven European countries, more than 90 per cent of households have a computer, and in six countries more than 90 per cent of households have Internet access. Eastern European countries are catching up and increasing the number of households with Internet access. Bulgaria, for example, stands out with a growth in household penetration from 33 per cent in 2010 to 45 per cent in 2011. Great progress has also been made in Romania and the Czech Republic. Mobile-cellular penetration has reached saturation levels in most countries. Only four European countries (Cyprus, Bosnia and Herzegovina, Turkey and Albania) have not yet reached the 100 per cent mobile-cellular penetration mark.

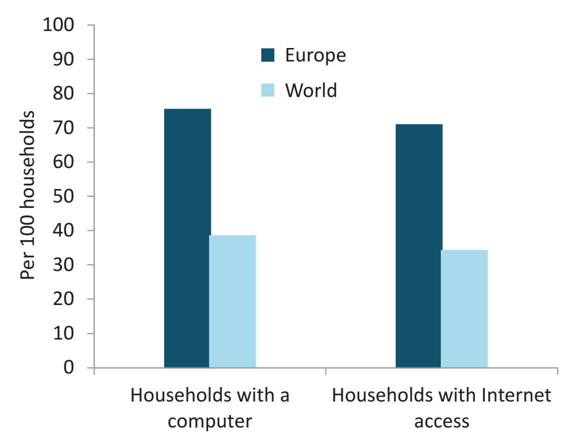
As mentioned earlier, most growth is taking place on the indicators included in the use sub-index, and mobile-broadband penetration in particular. Nordic countries Sweden, Finland and Denmark rank highest in Europe on this indicator, with penetration rates of 92, 80 and 70 per cent, respectively. Albania, which ranks at the bottom of the regional IDI, was the last European country to launch 3G commercially, and attained a mobile-broadband penetration of 9 per cent by end 2011. Europe is the region with the highest average mobile-broadband penetration, at 37 per 100 inhabitants in 2011 (compared with 16 per cent globally), and likewise the world leader in terms of fixed (wired)-broadband penetration, which reached an average value of 25 per 100 inhabitants (compared with 9 per cent globally) by end 2011. Many countries display a very high fixed (wired)-broadband penetration rate, most notably Switzerland, the Netherlands (both 39 per cent) and Denmark (38 per cent), which rank highest worldwide on this indicator. The number of Internet users is generally very high in the region, too, with seven European countries at the top on this indicator, recording penetration rates

Chart 2.12: Households with Internet access, Europe, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

Chart 2.13: Households with a computer and households with Internet access, Europe and world, 2011



Source: ITU World Telecommunication/ICT Indicators database.

of around 90 per cent or more. Nonetheless, a number of countries, including Albania, Romania, Serbia and Turkey, have a relatively small proportion of the population online (less than 50 per cent).

The Americas

The regional IDI ranking is headed by the North American countries United States and Canada. Both achieved an IDI of above seven. The IDI scores for all other countries from the Americas region remain below seven, El Salvador, Cuba, Honduras and Nicaragua ranking last with an IDI of below three (see Table 2.18). As pointed out before, the Americas region has the second highest range in IDI values (after the Asia and the Pacific region). This reflects the diversity of the region which comprises, at one end of the scale, rich, developed countries (United States and Canada) that are very advanced in terms of ICT development, and, at the other, a majority of lower- and upper-middle income developing countries. Nevertheless, the regional ranking has a strong centre with most countries attaining IDI values of three or four, and the regional average IDI of 4.26 is above the global average of 4.15 (see Chart 2.7).

Two countries from the Americas region, Brazil (see Box 2.2) and Costa Rica, are among those that made most progress in the IDI from 2010 to 2011. Both countries likewise feature among the most dynamic countries in terms of the access sub-index, which also include the Latin American countries Ecuador and Uruguay. All four made impressive strides in connecting more households to the Internet, especially Brazil, where the proportion of households with Internet access shot up from 27 per cent in 2010 to 38 per cent in 2011. Mobile-cellular penetration also increased, in particular in Costa Rica, where the mobile market was liberalized in 2011. The majority of countries in the region now exceed 100 per cent mobile-cellular penetration. The United States was one of the last developed countries to pass this threshold, penetration having increased to 106 per cent in 2011. A number of Caribbean island states, which are small in terms of population and thus total number of Internet users, have very high international Internet bandwidth per Internet user. For example, St. Vincent and the Grenadines boasts the second highest ratio after Hong Kong (China). Antigua and Barbuda, Barbados and Costa Rica likewise have very high bandwidth per Internet user.

In the use sub-index of the IDI, by far the largest increases in the region were in mobile-broadband penetration (see Chart 2.14). For example, mobile-broadband penetration more than doubled in Brazil and Chile, to 17 and 21 per cent, respectively, by end 2011. Following the launch of 3G in Antigua and Barbuda in 2011, the country reached an impressive 20 per cent penetration by the end of the year.[63] Five countries from the Americas – Cuba, Barbados, Guyana, St. Vincent and the Grenadines and Saint Lucia – remain without mobile-broadband services. In the latter three, however, fixed (wired) broadband is important, and reaches a relatively high penetration level in Barbados (22 per cent). The United States is one of the countries with the highest broadband penetration levels worldwide, recording a mobile-broadband penetration of 65 per cent and a fixed (wired)-broadband penetration of 29 per cent. Canada does equally well in global comparison, with penetration rates of around 32 per cent for both indicators.

While the United States and Canada are among the highest ranked countries on all three indicators making up the use sub-index, most other countries in the region still display relatively low use sub-index values. A number of countries have seen their global ranking fall, mostly because of lack of growth in the use sub-index. In particular, this includes countries where 3G services have not yet been launched (such as Guyana and Saint Lucia), as well as countries where

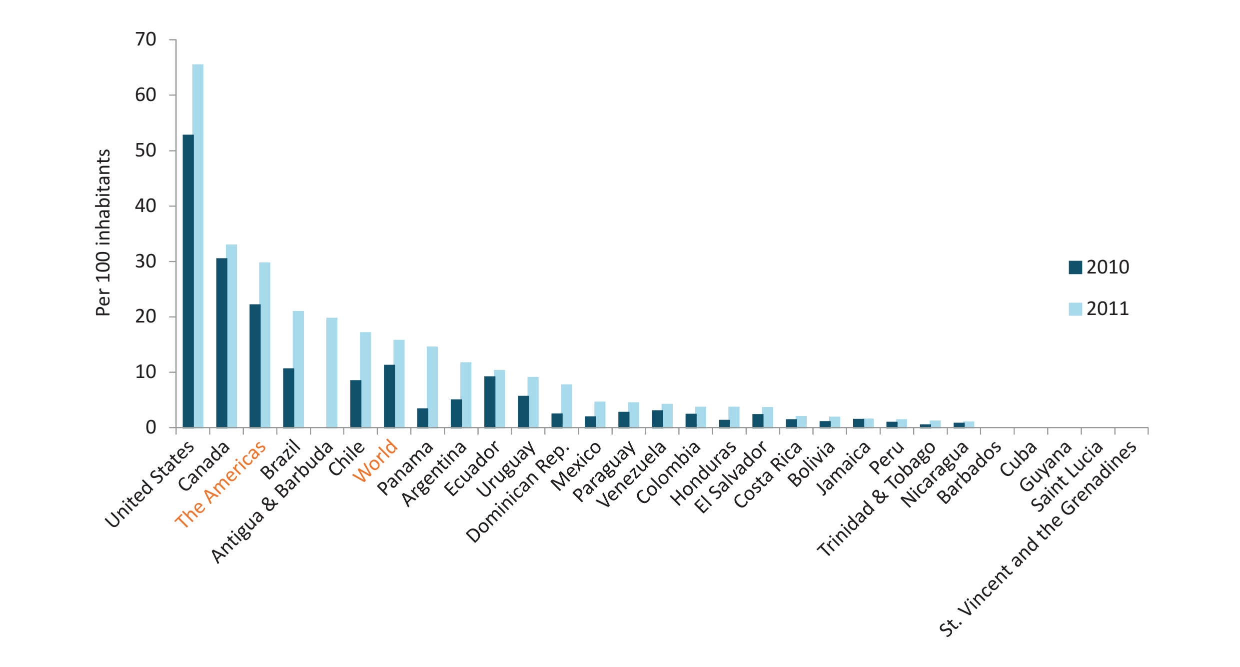
Table 2.18: IDI – The Americas

Economy	Regional rank 2011	Global rank 2011	IDI 2011	Global rank 2010	IDI 2010	Global rank change 2010-2011
United States	1	15	7.48	16	7.11	1
Canada	2	22	7.04	20	6.87	-2
Barbados	3	34	6.07	32	5.91	-2
Antigua & Barbuda	4	43	5.74	44	5.35	1
Uruguay	5	50	5.24	49	4.89	-1
Chile	6	55	5.01	58	4.63	3
Argentina	7	56	5.00	55	4.72	-1
St. Vincent and the Grenadines	8	59	4.74	59	4.58	0
Brazil	9	60	4.72	67	4.17	7
Trinidad & Tobago	10	61	4.57	60	4.42	-1
Saint Lucia	11	64	4.49	61	4.36	-3
Panama	12	66	4.41	63	4.21	-3
Costa Rica	13	71	4.37	71	3.94	0
Colombia	14	76	3.93	76	3.73	0
Venezuela	15	77	3.92	74	3.78	-3
Mexico	16	79	3.79	78	3.60	-1
Ecuador	17	82	3.68	85	3.41	3
Peru	18	86	3.57	82	3.43	-4
Jamaica	19	89	3.49	84	3.42	-5
Dominican Rep.	20	93	3.34	91	3.19	-2
Paraguay	21	97	3.14	99	2.94	2
Bolivia	22	98	3.13	100	2.93	2
Guyana	23	99	3.12	95	3.02	-4
El Salvador	24	103	2.99	102	2.89	-1
Cuba	25	106	2.77	107	2.66	1
Honduras	26	107	2.72	106	2.71	-1
Nicaragua	27	113	2.44	111	2.31	-2
Average			4.26		4.04	

Source: ITU.
Note: Simple average.

penetration is low and growth rates are marginal (such as Peru and Venezuela). It is noteworthy that, in a number of countries, the IDI use sub-index lags behind the potential suggested by a relatively high access sub-index. Panama and Costa Rica, for instance, have above-average access sub-index values of 5.16 and 5.28, but their use sub-index scores of 2.34 and 1.95, respectively, remain below the global average. The same holds true for Saint Lucia and St. Vincent and the Grenadines. All of these countries harbour considerable potential for increasing ICT usage, but have yet to make the transition from stage 1 (ICT access) to stage 2 (ICT usage), i.e. to make full use of their relatively well-developed ICT infrastructure. In Costa Rica, Saint Lucia and St. Vincent and the Grenadines, the skills sub-index value is below the global average, which may help to explain why ICT usage is low despite relatively widespread ICT access.

Chart 2.14: Active mobile-broadband penetration in the Americas, 2010 and 2011



Source: ITU World Telecommunication/ICT Indicators database.

Endnotes

1 This section is based on the 2011 edition of *Measuring the Information Society*. The presentation of the conceptual framework and methodology of the IDI is maintained in each version of the report, to help the reader. The reader is also advised to consult the 2009 edition of *Measuring the Information Society*, which provides more information on the development of the IDI concept and methodology. Annex 1 to this report describes the methodology in more detail.

2 The ITU indicator "active mobile-broadband subscriptions" (see ITU, 2011a) is referred to in this publication as "mobile-broadband subscriptions".

3 Data on the indicators included in the skills sub-index are sourced from the UNESCO Institute for Statistics (UIS). See Annex 1 for more details on the definition of the indicators.

4 In this context, the recommendations made by experts in relation to the development of the single index were taken into consideration. Between 2007 and 2008, ITU maintained an online discussion forum with more than 100 participants on the preparation of the single index.

5 For more information on the EGTI online forum, see: http://www.itu.int/ITU-D/ict/ExpertGroup/default_group.asp.

6 ITU (2010), Chapter 2, Box 2.1, provides more insight on the need to improve data quality through household ICT statistics.

7 The revision was part of the overall review of ITU's infrastructure indicators, and was carried out through its Expert Group on Telecommunication/ICT Indicators (EGTI). Active mobile-broadband subscriptions include (a) standard mobile subscriptions with use of data communications at broadband speeds (i.e. mobile-cellular subscriptions with advertised data speeds of 256 kbit/s or greater and which have been used to set up an Internet data connection) and (b) dedicated mobile data subscriptions at broadband speeds (i.e. subscriptions to dedicated data services over a mobile network which are purchased separately from voice services, either as a standalone service – e.g. using a data card such as a USB modem/dongle – or as an add-on data package to voice services requiring an additional subscription). For more information, see ITU (2011a).

8 In the previous edition of the report, 2010 data were sourced from Wireless Intelligence.

9 While no country has a value of 0, a number of countries have values between 0 and 1, in particular in the use sub-index.

10 References to income levels are based on the World Bank classification, see: http://data.worldbank.org/about/country-classifications/country-and-lending-groups.

11 Of these households, according to figures from the Fibre-to-the-Home Council, FTTH/FTTB penetration stands at 55 per cent in mid-2011, which makes the Republic of Korea the world leader. See http://www.ftthcouncil.org/sites/ftthcouncil.org/files/2012_global_ranking_ftth_g20_countries.pdf.

12 The Republic of Korea ranks first in the UN E-Government Survey, see http://www2.unpan.org/egovkb/global_reports/12report.htm.

13 The target group for the survey is the general public in Sweden between the ages of 16 and 75. The survey uses a random sample representing Sweden and encompassing 4 000 individuals. The data were compiled during August and September 2011.

14 See https://www.borger.dk/Sider/default.aspx.

15 See http://www.opta.nl/en/news/all-publications/publication/?id=3590.

16 See http://www.arcep.fr/uploads/tx_gspublication/etude-Analysy-Mason-usages-THD-fev2012.pdf.

17 The exceptions are the United Kingdom (as already featured in the top performers section) and Estonia.

18 WiMAX subscriptions are not included in fixed (wired)-broadband subscriptions and thus WiMAX penetration is not reflected in the IDI calculation.

19 UNDESA counts Bahrain in the Western Asia subregion for the purpose of the survey.

20 See http://mobile.bahrain.bh/egov/wap/wml/mobile/common/loadHome.do and http://bit.ly/L0M1Ar.

21 See http://www.mpt.gov.by/en/content/1928.

22 Mobile-broadband subscriptions include GPRS, WCDMA and CDMA2000.

23 As of February 2012, only the city of Nazária in the State of Piaui (8 000 inhabitants) is not covered by mobile-cellular operators.

24 See http://www.teleco.com.br/en/en_cobertura.asp.

25 See http://www.mc.gov.br/acoes-e-programas/programa-nacional-de-banda-larga-pnbl/252-temas/programa-nacional-de-banda-larga-pnbl/23723-termos-de-compromisso.

26 See also Chapter 3, p. 98 of this report.

27 See http://www.mc.gov.br/todas-as-noticias/24030-200112-internet-nos-moldes-do-pnbl-chega-a-mais-221-cidades.

28 See http://www.teleco.com.br/ncel.asp.

29 See http://www.teleco.com.br/3g_cobertura.asp.

30 See http://www4.planalto.gov.br/brasilconectado/pnbl/acoes/acoes-de-nivel-iii.

31 See http://www.telecomsinsight.com/file/92741/costa-rica-telecoms-ready-to-reach-potential.html.

32 Claro (AmericaMovil) and Movistar (Telefonica) launched services in the country in 2011, see http://www.telecompaper.com/news/claro-launches-mobile-operations-in-costa-rica and http://www.americamovil.com/amx/cm/reports/Q/1Q12EN.pdf.

33 See http://estonia.eu/about-estonia/economy-a-it/e-estonia.html.

34 See http://wirelessfederation.com/news/13515-vodafone-fiji-rolls-out-3g-network/. The Telecommunications Authority of Fiji was formally established in March 2011 and started collecting and reporting data on mobile-broadband subscriptions at that time.

35 See: http://mtn.com.gh/sub.aspx?ID=213&MID=109&ParentID=89&FirstParentID=5&Level=3&FirstIsClosed0=N&SecondIsClosed01=N.89.

36 See http://www.rdb.rw/departments/information-communication-technology/overview.html and http://www.telegeography.com/products/commsupdate/articles/2011/01/07/rollout-of-national-fibre-optic-backbone-complete/

37 It has to be noted that Saudi Arabia's mobile-broadband penetration rate has been revised from 58 per cent to 9.8 per cent for 2010. Furthermore, there is a break in comparability between 2010 and 2011 data.

38 See http://www.eassy.org/index-2.html and http://www.techzim.co.zw/2011/03/telone%E2%80%99s-fibre-connection-on-eassy-now-live-total-2-48-gbps-lit/.

39 "Smart" can be understood as "an application or service that is able to learn from previous situations and to communicate the results of these situations to other devices and users" (OECD, 2012a).

40 ITU's Telecommunication Standardization Sector (ITU-T) is leading several standardization initiatives to promote the development of the Internet of Things. For more information, see http://www.itu.int/en/ITU-T/techwatch/pages/internetofthings.aspx.

41 WiMAX access, however, is growing in some developing countries, and can be a valid alternative service for businesses in the absence of fixed (wired) broadband.

42 The coefficient of variation (CV) aims to describe the dispersion of a variable in a way that does not depend on the variable's measurement unit. The higher the CV, the greater the dispersion in the variable.

43 The 155 economies included in the IDI were grouped into four categories (high, upper, medium, and low) based on the 2011 IDI values using quartiles to divide the data set into four equal groups.

44 The R-squared value provides a measure of how good one variable is at predicting another. It varies from 0 to 1, the latter being the value obtained by a perfect fit of the data points. In the case of the IDI and IPB, the higher the R-squared value, the stronger the correlation between the IDI and IPB, following a power function.

45 See previous endnote. In the case of the IDI and GNI per capita, the higher the R-squared value, the stronger the correlation between the two variables, following a logarithmic function.

46 See http://tel_archives.ofca.gov.hk/en/press_rel/2011/Jan_2011_r1.html and http://tel_archives.ofca.gov.hk/en/submarine/main.html.

47 See http://tel_archives.ofca.gov.hk/en/press_rel/2011/Jan_2011_r1.html.

48 See http://www.gov.hk/en/about/abouthk/factsheets/docs/telecommunications.pdf.

49 See http://www.ofca.gov.hk/filemanager/ofca/en/content_92/majortasks_12-13_e.pdf.

50 See http://www.gov.hk/en/about/abouthk/factsheets/docs/telecommunications.pdf.

51 See http://tel_archives.ofca.gov.hk/en/press_rel/2011/Feb_2011_r1.html.

52 See http://speedtest.ofca.gov.hk/.

53 The 2010 mobile-cellular subscription figures only include the operator MTC.

54 See http://www.eassy.org/index-2.html and http://www.techzim.co.zw/2011/03/telone%E2%80%99s-fibre-connection-on-eassy-now-live-total-2-48-gbps-lit/.

55 See http://www.telegeography.com/products/commsupdate/articles/2011/07/06/bandwidth-bonanza-boosts-buoyant-beirut-submarine-link-finally-on/.

56 Teens are defined as being aged 12-15.

57 The regions in this chapter refer to the ITU/BDT regions, see: http://www.itu.int/ITU-D/ict/definitions/regions/index.html.

58 See endnote 42.

59 See endnote 53.

60 It should be noted that WiMAX, which has not been included in the IDI calculations, is an important Internet access technology in many of the Arab States.

61 Thailand, Tuvalu, Islamic Republic of Iran and Papua New Guinea had not launched 3G commercially by end 2011.

62 See http://ec.europa.eu/information_society/digital-agenda/scoreboard/index_en.htm.

63 This penetration rate represents at total of 17 651 mobile-broadband subscriptions, in a country with 88 710 inhabitants.

Chapter 3. The ICT Price Basket (IPB)

3.1 Introduction

The ITU ICT Price Basket (IPB) is a unique global benchmarking tool that provides insightful information on the cost and affordability of telecommunication and information and communication technology (ICT) services. The IPB is composed of three distinct prices – for fixed-telephone, mobile-cellular and fixed-broadband services – and computed as a percentage of countries' average gross national income (GNI) per capita. This puts prices into perspective, and makes it possible to monitor the affordability of ICT services. Prices are also presented in United States dollars (USD) and in purchasing power parity (PPP) terms, but countries are ranked on the basis of the relative cost (or affordability) of ICT services within the country, i.e. as a percentage of GNI per capita. Besides comparing absolute and relative prices, the chapter also provides information on global and regional trends, and points to the difference in prices between developed and developing countries. This year, the information relates to price trends from 2008 to 2011.

The price of ICT services has a significant impact on the demand for and spread of ICTs. Prices strongly influence how many people are able and willing to subscribe to a service. The concept of 'affordability' is useful for service providers, policy-makers and analysts in ascertaining the potential user base of ICTs and identifying limits on ICT uptake. A comparison between countries can help identify realistic price targets, but also best practices, and highlight bottlenecks and shortcomings. An analysis of the information society must not only consider and understand such factors as ICT infrastructure, awareness or skills, but also take into account the cost and affordability of services. This makes the IPB an important policy instrument within the broader context of ICT developments. The fact that this report includes both the ICT Price Basket and the ICT Development Index (IDI) further recognizes that ICT prices and affordability are an important factor for ICT uptake.[1] The choice to consider mobile-cellular, fixed-telephone and fixed-broadband prices reflects the importance of these technologies in delivering access to today's information society.

As Chapter 1 of this report has shown, the mobile-cellular market remains one of the fastest growing telecommunication markets in history. While over the past year growth was modest in developed countries, which attained mobile-cellular subscription penetration levels of over 120 per cent in 2011, developing countries continue to register double-digit growth in the number of subscriptions. ITU estimates the number of mobile-cellular subscriptions at over 6 billion by early 2012, compared to around 4 billion four years earlier. Over the same period, the mobile-cellular market has witnessed a strong and far-reaching liberalization process, accompanied by big price reductions. This chapter will show that between 2008 and 2011 the mobile component of the ICT Price Basket fell by around 37 per cent.

Prices for fixed-broadband Internet access are also falling significantly.[2] Between 2010 and 2011 alone, the fixed-broadband component of the ICT Price Basket dropped by 32 per cent, while data caps and fixed-broadband

speeds are being raised. At the same time, the number of fixed-broadband subscriptions continues to grow, to close to 600 million by end 2011, with more and more people subscribing to high-speed connections to access the Internet.

Although the number of fixed-telephone subscriptions has declined slightly since 2008, the extent of the public switched telephone network remains important, not only to deliver basic voice services but also as a basic infrastructure for the delivery of high-speed fixed-broadband (DSL) Internet access, which remains the most commonly deployed fixed-broadband technology worldwide. The usefulness of including a separate fixed-telephone sub-basket in the medium to long term is debatable, particularly in view of the strong growth in mobile-broadband subscriptions and given that some countries have very small numbers of fixed-telephone subscriptions.[3] Section 3.5 will highlight the growing importance of mobile-broadband services and discuss the importance and challenges of adding a mobile-broadband sub-basket.

Objectives of the ICT Price Basket

The main objective of the ICT Price Basket is to provide information on the cost and affordability of ICT services across countries and regions, and over time. Prices for the IPB have been collected annually by ITU since 2008, and in this chapter 2010 and 2011 prices are presented for all countries included in the price basket. The IPB allows policy-makers to evaluate the price and affordability of ICT services in their country and to benchmark them against those in other countries. It enables them to assess the impact which specific projects and policies, such as the licensing of additional operators, the introduction of mobile number portability (MNP) or the liberalization of international gateway services, may exert on entry-level prices. Last but not least, it also offers a starting point for looking into ways of lowering prices – for example, by introducing or strengthening competition, or by reviewing specific pricing policies.[4] It is important to note that the IPB is based on entry-level plans and low-usage profiles, and therefore does not reflect the affordability of higher-level offers and usage profiles.

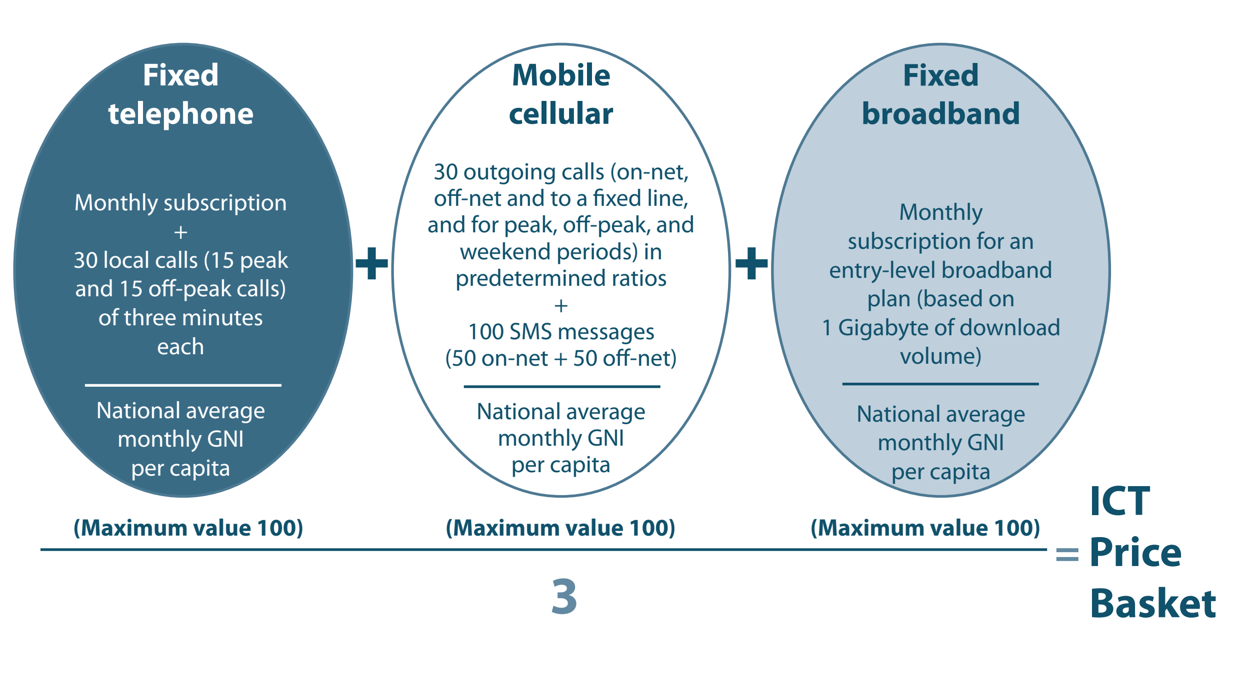
This chapter will first provide an overview of the methodology of the ICT Price Basket, and present some of its strengths and weaknesses. Next, it will present the overall 2008-2011 trend in the IPB. This trend analysis will highlight global price developments and look at differences between developed and developing countries. It will also show trends over the same time period for each one of the sub-baskets. Then, the latest (2011) IPB, which is based on 2011 prices, will be presented for all countries and compared to 2010 prices. Section 3.4 will provide a regional analysis of price trends over time and highlight major differences and developments within each of the six ITU regions. There are many factors influencing the cost and price of ICT services. They include a market's size, the level and degree of privatization and competition, and regulatory intervention and policies. This chapter focuses on global and regional price trends, points to differences between countries and highlights selected economies that have made progress in making ICT services more affordable. Although the regional analysis in this chapter will make reference to national and regional policies and highlight possible factors influencing ICT prices for some countries, it will not include a detailed analysis of prices at the country level.

Finally, the chapter will provide an overview of 2011 mobile-broadband prices in over 120 economies, based on a pilot data-collection exercise carried out by ITU. It will discuss some of the key findings and address methodological issues and challenges faced in collecting and harmonizing mobile-broadband prices. This discussion will provide the basis for eventually adding a mobile-broadband sub-basket to the IPB.

3.2 ICT Price Basket methodology

The ICT Price Basket is a composite basket that includes three price sets, referred to as sub-baskets: fixed-telephone, mobile-cellular and fixed-broadband services. The IPB is the value calculated from the sum of the price of each sub-basket (in USD) as a percentage of a country's monthly GNI per capita[5] divided by three (Figure 3.1). For this exercise, the cost of each sub-basket as a percentage

Figure 3.1: ICT Price Basket methodology



Note: 1) In countries where no mobile prepaid offers are available, or where the number of mobile-prepaid subscriptions represent less than 2 per cent of the total number of mobile-cellular subscriptions, the monthly fixed cost (minus the free minutes included, if applicable) of a postpaid subscription is added to the basket. In the 2011 IPB this is the case only for Japan and the Republic of Korea, where prepaid mobile-cellular subscriptions represent less than 2 per cent of total mobile-cellular subscriptions.
2) The 30 outgoing mobile calls are equivalent to a total of 50.87 minutes. For more details on the OECD/Teligen methodology, see Annex Table 2.1.
3) For monthly fixed-broadband Internet plans that limit the amount of data transferred by including caps below 1 Gigabyte, the cost for additional bytes is added.
For more information on the IPB methodology, see Annex 2 to this report.

Source: ITU.

of the monthly GNI per capita is limited to a maximum value of 100, so the final price basket value may vary between a theoretical 'zero' (prices represent 'zero per cent of average monthly GNI per capita', and all three services are for free), and 100 (the price of all three sub-baskets is equal to, or exceeds, the monthly GNI per capita). This means that the IPB gives equal weight to each of the three ICT service components. Based on the IPB value, countries are ranked from 1 to 161 (the total number of countries included in the 2011 ICT Price Basket).

Data for the three ICT services are collected through the ITU ICT Price Basket Questionnaire, which is sent out annually to all ITU Member States/national statistical contacts.[6] For all countries that did not reply to the questionnaire, prices are gathered directly from national operators' websites, in local currencies, and converted into USD.[7] The only reason for any of ITU's 193 Members States not being included in the ICT Price Basket is the unavailability of one or more of the prices used to compute the IPB.

Given the increasing number of countries launching 3G networks and the growing number of people that access the Internet over a mobile-cellular network, it is expected that mobile-broadband prices will eventually be included in ITU's ICT Price Basket. While national and international efforts to track mobile-broadband uptake and usage are on the rise, the harmonization of data to monitor mobile-broadband prices is still under discussion. The challenges of comparing mobile-broadband prices internationally are further discussed in section 3.5 of this chapter.

Fixed-telephone prices

The fixed-telephone sub-basket represents the cost of local fixed residential telephone services. It includes the monthly subscription fee charged for subscribing to the public switched telephone network (PSTN), plus the cost of 30 local calls of three minutes each to the same (fixed) network (15 peak and 15 off-peak calls). See Annex 2 for more information on the fixed-telephone sub-basket methodology.

Mobile-cellular prices

The mobile-cellular telephony sub-basket is largely based on, but does not entirely follow, the 2009 methodology of the OECD low-user basket.[8] It gives the price of a standard monthly usage of mobile services, as determined by OECD. It includes 30 outgoing calls per month (on-net, off-net and to a fixed line, and for peak and off-peak periods) in predetermined ratios, plus 100 sms messages.

The mobile-cellular sub-basket used in the IPB is based on prepaid prices, although postpaid prices may be used for countries where prepaid subscriptions make up less than 2 per cent of all mobile-cellular subscriptions. Prepaid prices represent the dominant payment method in the majority of countries, and are often the only payment method available to low-income users, who may not qualify for a postpaid subscription. By end 2011, 72 per cent of all mobile subscriptions worldwide were prepaid. See Annex 2 for more information on the mobile-cellular sub-basket methodology.

Fixed-broadband Internet prices

The fixed-broadband sub-basket is calculated on the basis of the price of the monthly subscription to an entry-level fixed-broadband plan. For comparability reasons, the fixed-broadband sub-basket is based on a monthly usage of (a minimum of) 1 Gigabyte (GB). For plans that limit the monthly amount of data transferred by including caps below 1 GB, the cost of additional bytes is added to the sub-basket up to 1 GB. Refer to Annex 2 for more details on the fixed-broadband sub-basket methodology.

Calculating the three price sub-baskets

The sub-baskets for fixed-telephone, mobile-cellular and fixed-broadband prices are presented as follows:

- In USD, using the average annual UN operational rate of exchange, which is based on market exchange rates.

- In international dollars (PPP$), using purchasing power parity (PPP) conversion factors instead of market exchange rates. The use of PPP exchange factors helps to screen out price and exchange-rate distortions, thus providing a measure of the cost of a given service taking into account the purchasing power equivalences between countries.[9]

- As a percentage of countries' monthly GNI per capita (Atlas method)[10], latest available data, capped at 100 per cent. This implies that the lower the percentage, the lower the relative cost of the service. The value of the sub-baskets is capped at 100 per cent for the purpose of calculating the overall ICT Price Basket so that a very high relative price of, for example, fixed-broadband services does not distort the overall IPB. This means that a sub-basket value could exceed 100 per cent, indicating that the price of the service in question would exceed the average monthly GNI per capita. This is the case in some countries for the fixed-broadband service.

Strengths and weaknesses of the IPB

The main strength of the ICT Price Basket is that it provides a fair international comparison of absolute and relative prices for ICT services over time. As a benchmarking tool, it further raises awareness of the major influence that ICT prices have on ICT development, and allows governments to identify and evaluate policies that enhance ICT uptake.

Like any benchmarking tool that covers a large number of countries and reduces a complex reality into one single value, the IPB has its shortcomings. Detailed research on ICT prices has shown that pricing policies and plans across countries and even operators vary as much as prices themselves. Therefore, the need to harmonize prices and make them comparable across countries leads to some distortions, and prices may not always reflect what the majority of people are actually paying. Since the IPB includes a very large number of countries (161), including the large majority of the world's developing countries, it is based on entry-level offers and packages, as this is what

Box 3.1: Low-cost provider Free Mobile shakes up the French market

When Free Mobile, France's fourth mobile-cellular operator, went live on 10 January, 2012, it had a truly 'disruptive' impact on the French mobile-cellular market. The operator, which provides services over its own network and through a national roaming agreement with Orange, was already providing fixed-broadband and TV services and made a splash by offering lower and simpler mobile prices. This has forced competitors to follow suit or, at least, react.

One of its key deals is the EUR 19.99 unlimited package, which offers new mobile customers free calls to fixed networks in France, overseas territories and 40 international destinations in Europe and the United States, plus free calls to mobile phones in France, the US and Canada. The package, which has no contractual tie-in period, further includes unlimited sms/mms and Internet with VoIP, Wi-Fi and 3G/3G+ up to 3 GB a month. According to the operator "it is 2.5 times cheaper than the best price of any competitor". Free Mobile further offers a EUR 2 per month package for 60 minutes of calls and 60 sms, with additional sms charged at EUR 0.05, around half the price of its competitors.[12]

Based on this latter offer by Free Mobile, the ITU mobile-cellular sub-basket would amount to no more than EUR 4 (EUR 2 for the 60 free minutes and sms and another EUR 2 for the additional 40 sms), compared with over EUR 30 for the 2011 mobile-cellular sub-basket, which is calculated on the September 2011 prices on offer from the country's operator with the largest market share.

Free's offers hardly went unnoticed, and competitors reacted by readjusting their own packages and lowering prices in order to compete and retain customers.[13] One operator not only announced steep price and revenue cuts, but also stated that harsh competition would force it to lay off up to 500 employees.[14]

Besides having a profound impact on its competitors, and causing a price battle, the market shake-up also led to a sharp rise in mobile number portability (MNP), from 12 000 requests a day in 2011 to 40 000 following the first three weeks of the launch of Free Mobile.[15] It also caused some controversy, including allegations that Free Mobile had become a victim of its own success, and that its network was insufficient and congested, charges that the regulator has at least partly proved to be wrong.[16] While it may be too early to assess the feasibility and long-term impact of these new developments, this example illustrates the dynamics of highly competitive mobile-cellular markets.

low-income subscribers are most likely to use. It should be noted, however, that entry-level services tend to be more expensive (compared to relatively cheaper prices per minute or per bit/s for high-user packages), since operators cannot leverage economies of scale and, in the case of prepaid services, cannot count on a guaranteed amount of consumption and revenues.

Therefore, the IPB does not necessarily show the cheapest offers and options available, for example for high-end users. More sophisticated packages and offers, which include more minutes/bytes/sms, or bundled packages that combine several services, are also not taken into consideration.

The IPB is based on the dominant market player in terms of the number of subscriptions within each ICT service. It does not represent an average of several operators or packages. Since one of the assumptions in an increasingly competitive ICT market is that operators are adjusting their prices to competitors, prices should in theory not differ substantially between operators, at least over time. While a recent example from France appears to substantiate this assumption by showing that in a highly competitive environment the entry of a new market player can have a rapid impact on prices (Box 3.1), there are examples of countries with important price disparities, especially when operators hold very different market shares.[11]

Finally, the IPB does not take into account all price-related issues that are important to users, regulators and operators. For example, it does not consider roaming charges, or address other areas where regulators may intervene, such as price transparency or contract commitments (Box 3.2).

The IPB does not take into account special offers that are limited to a certain time period, since these are not likely to be representative over time. In some cases, special (i.e. time-bound) offers are advertised all-year round, although the operator reserves the right to cancel the offer at any given time. Furthermore, the IPB does not necessarily reflect the type of service or plan to which most users are actually subscribing in all countries. For example, the mobile-cellular

Box 3.2: Roaming matters

Many mobile-cellular users have gone through the painful experience – often referred to as bill shock – of paying for unexpectedly high mobile-cellular charges, for example for roaming. In the wireless market, roaming refers to the ability of customers to move from their original (geographic) coverage area (usually the national boundaries of a country) to another area (i.e. another country) without an interruption in the service or connectivity and keeping the same telephone number. Roaming, which applies to all mobile services (voice, sms, data), is particularly convenient for people who travel a lot.

A key problem with roaming is that its provision is usually not included in service packages and customers are often unaware of the charges that apply to roaming. Also, roaming charges are usually significantly higher (per minute/call) than the regular charges that customers are billed for national calls. Many complaints have been made about unreasonably high roaming charges, which allow operators to make very high profits. To protect customers, an increasing number of regulators have reacted by regulating roaming charges through various means.

Some of the earliest and strictest roaming rules were implemented by the European Commission, which decided to regulate roaming voice prices across the EU in 2007 (European Commission, 2007). In the revision of the roaming regulation carried out in 2009, it was decided that as of mid-2010 operators in the EU should discontinue users' data roaming services when a limit of EUR 50 was reached (European Commission, 2009a). The cut-off limit is adjustable by end users, and operators are obliged to send users a warning as they hit 80 per cent of their data-roaming bill limit. Once the limit has been reached, data roaming services are discontinued unless the user gives explicit consent to continue using them. Roaming for sms services was also regulated under the 2009 Roaming Regulation, and voice roaming maximum prices were further reduced. Currently, the European Parliament is discussing plans to further reduce roaming tariffs, and is seriously considering the regulation of maximum retail data roaming prices (European Commission, 2011b). The long-term aim stated in the EU Digital Agenda is that "the difference between roaming and national tariffs should approach zero by 2015" (European Commission, 2010). Following the EU example, OECD has made a number of recommendations to cut high roaming costs, for example by promoting "transparent information on roaming prices" or by establishing maximum prices (OECD, 2009a).

Other examples of regional roaming regulation include the Gulf Cooperation Council's (GCC) decision to regulate roaming charges, which led to the setting of maximum prices for roaming services within GCC countries in the second half of 2010 (UAE Telecommunications Regulatory Authority, 2010). Bahrain's Telecommunication Regulatory Authority (TRA) took some additional steps in early 2012. It imposed a cut in mobile roaming charges up to 75 per cent by setting a maximum charge for calls made by Bahraini mobile users within the GCC.

In the US, the Federal Communications Commission (FCC) is working on a plan, called the Wireless Consumer Usage Notification Guidelines, which would oblige the country's mobile-cellular operators to send free warnings to customers incurring roaming charges (and those exceeding their monthly limits on voice and data allowances). According to FCC, "one in six cellphone users have experienced bill shock (...), and 23 per cent of those people saw unanticipated charges amounting to over USD 100".[19]

Roaming is not the only area where regulators have increasingly felt the need to intervene in order to protect customers. Other areas of consumer interest include quality of service, mobile number portability and transparency and type of contracts, including limiting operators' lock-in periods (often from 24 to 12 months) so as to give customers more flexibility in changing service providers.[20]

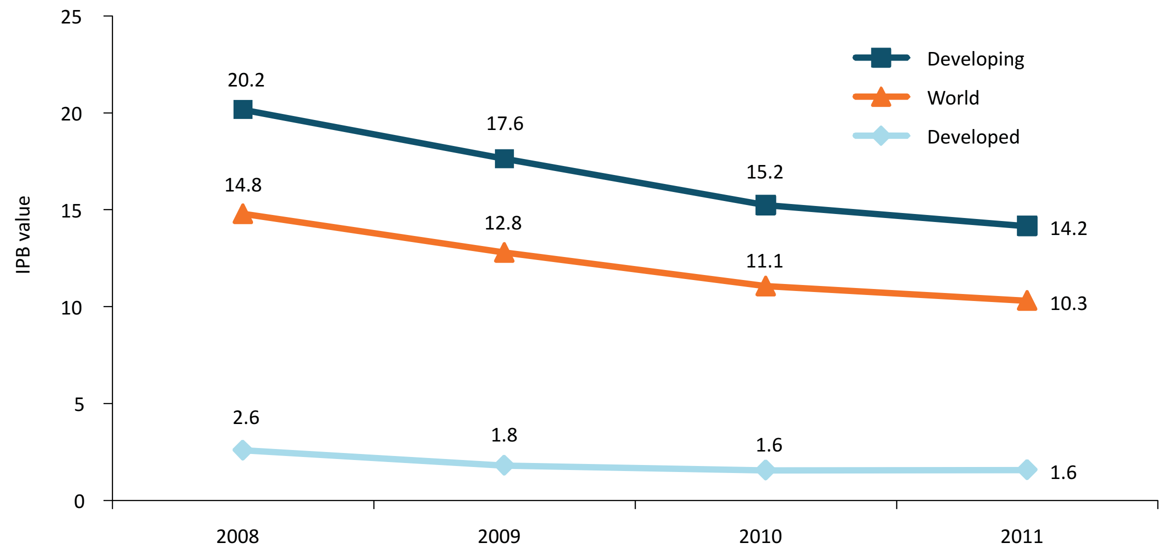
sub-basket is based on prepaid prices even though in some countries the majority of subscriptions are postpaid. An exception has been made for countries where less than 2 per cent of the total subscriptions are prepaid subscriptions. For these countries – namely, for 2011, Republic of Korea and Japan – postpaid prices were used. In this case, the monthly subscription fee for postpaid services applies and any free minutes included in the package are taken into consideration.[21]

While these shortcomings need to be taken into consideration, most of them only apply to a limited number of countries, and so the overall potential of the IPB as a powerful benchmarking tool is not jeopardized.[22]

3.3 ICT Price Basket and sub-basket results and analysis

A global trend analysis of IPB values for 2008-2011, based on the 144 economies for which IPB data are available for 2008, 2009, 2010 and 2011, shows that prices have decreased substantially over the four-year period. ICT services have become more affordable in both developed and developing countries. Globally, the IPB has decreased from 14.8 to 10.3. In developing countries, it has dropped from 20.2 in 2008 to 14.2 by 2011. Over the same time period, developed countries witnessed a fall in the IPB from 2.6 to 1.6 (Chart 3.1).

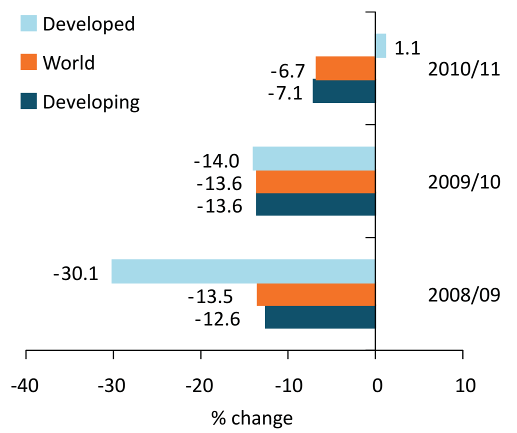
Chart 3.1: ICT Price Basket values, world and by level of development, 2008-2011



Source: ITU.
Note: Based on simple averages.

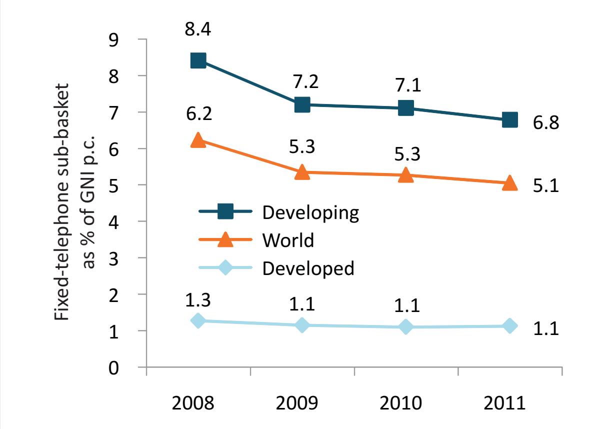
A year-by-year comparison shows that the strongest relative price drops took place in developed economies between 2008 and 2009, when the IPB value fell by over 30 per cent. A year later, prices fell by 14 per cent, and they seem to have stabilized since 2010. Developed countries actually witnessed a slight price increase between 2010 and 2011, mainly due to small increases in fixed-telephone but also fixed-broadband prices. At the same time, prices decreased more gradually in developing countries, where the IPB value dropped by 12.6 and 13.6 per cent between 2008 and 2009 and 2009 and 2010, respectively. Prices dropped less between 2010 and 2011, with a decrease in the IPB value of around 7 per cent (Chart 3.2).

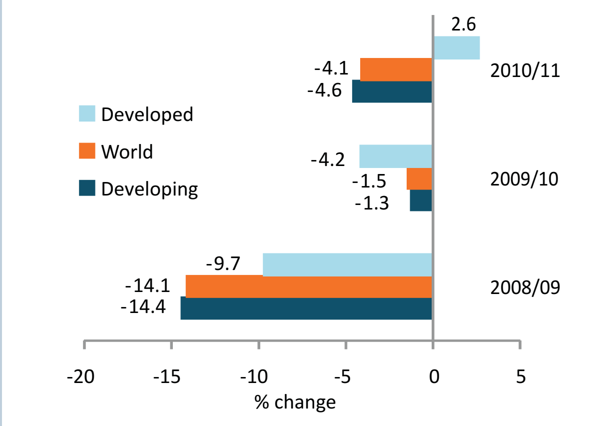
Chart 3.2: IPB annual change (%), world and by level of development



Source: ITU.
Note: Based on simple averages.

Chart 3.3: Fixed-telephone sub-basket (left) and annual change (right), 2008-2011





Source: ITU.
Note: Based on simple averages.

Trends in fixed-telephone, mobile-cellular and fixed-broadband prices, 2008-2011

All three sub-baskets show similar trends over the 2008-2011 period, with a steeper drop in prices between 2008 and 2009 and a more moderate price decrease (or stabilization) in the most recent years. This trend holds true for developed and developing countries alike, but there are – significant – variations between ICT services.

Fixed-telephone sub-basket

The fixed-telephone sub-basket displays the most moderate changes between 2008 and 2011, with an average global drop of around 19 per cent over that period. By 2011, the fixed-telephone sub-basket value stood at just over 1 per cent of GNI per capita in developed countries, as against just under 7 per cent in developing countries.

Price drops were most significant between 2008 and 2009, when the fixed-telephone sub-basket value decreased by 14.4 per cent in developing countries and 9.7 per cent in developed countries. A year later, fixed-telephone prices fell only marginally, particularly in developing countries. More recently, between 2010 and 2011, the fixed-telephone sub-basket value actually increased slightly (by 2.6 per cent) in developed countries, while falling by 4.6 per cent in developing countries (Chart 3.3).

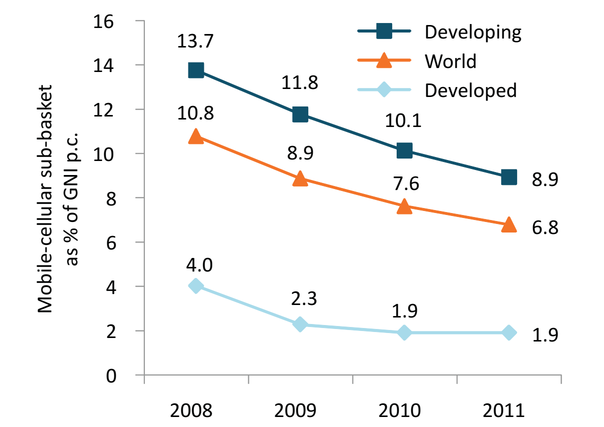
These developments suggest that fixed-telephone prices have changed only moderately over the last two years and are stabilizing.

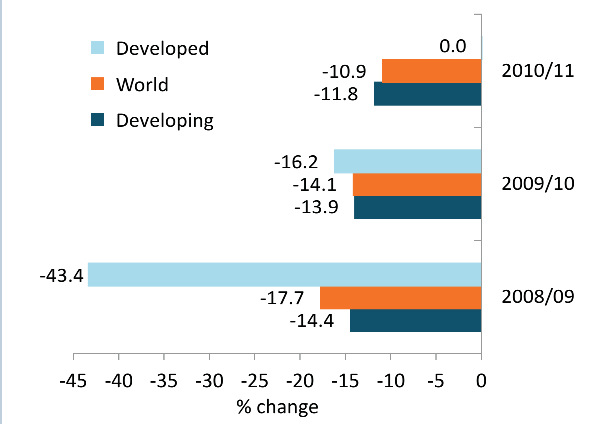
Mobile-cellular sub-basket

Mobile-cellular prices decreased significantly over the 2008-2011 period, by around 37 per cent globally. The mobile-cellular sub-basket, which in 2011 stood at just under 2 per cent of GNI per capita for developed countries and just under 9 per cent for developing countries, suggests that the difference in affordability between developed and developing countries is the least pronounced for mobile-cellular services.[23]

While mobile-cellular prices continued to drop globally by 10.9 per cent between 2010 and 2011, there are important differences between developed and developing countries. In developed countries, the mobile-cellular sub-basket decreased by as much as 43.4 per cent between 2008 and 2009, compared with 14.4 per cent in developing countries. However, whereas mobile-cellular prices in developing countries continued to fall by around 12 to 14 per cent a year over the following two years, prices in developed countries ceased to decline by 2010 (Chart 3.4). A high degree of liberalization and competition in developed countries has stabilized prices at a relatively low level.

Chart 3.4: Mobile-cellular sub-basket (left) and annual change (right), 2008-2011





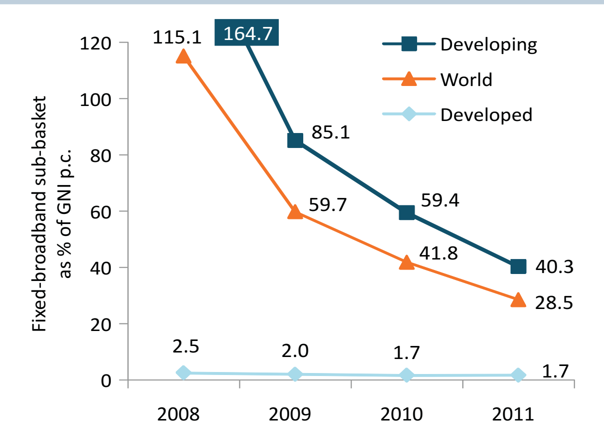
Source: ITU.
Note: Based on simple averages.

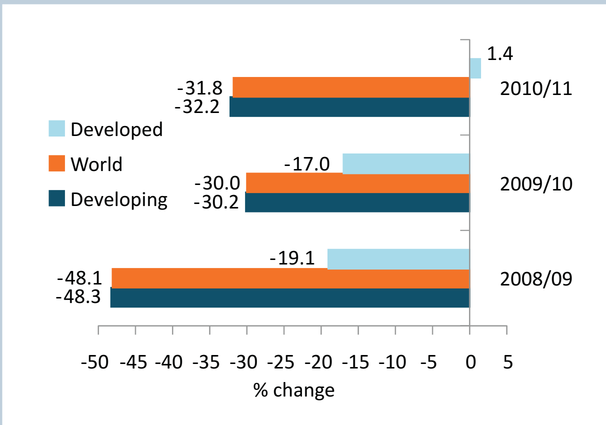
Fixed-broadband sub-basket

The fixed-broadband sub-basket witnessed the steepest fall (of about 75 per cent) between 2008 and 2011, with a particularly strong decrease in prices (of close to 50 per cent) in developing countries between 2008 and 2009 (Chart 3.5). By 2011, the fixed-broadband sub-basket stood at 1.7 and 40.3 per cent of GNI per capita for developed and developing countries, respectively, which is the greatest relative difference for any of the three sub-baskets. It is also noteworthy that the 2011 fixed-broadband sub-basket value for developed countries is lower than the mobile-cellular sub-basket, suggesting that fixed-broadband services have become relatively affordable. While a comparison shows that the price for an entry-level fixed-broadband service remains much higher in developing than in developed countries, a year-on-year analysis suggests that prices in developing countries are also dropping much faster.

Indeed, prices in developing countries have continued to fall by over 30 per cent annually between 2009 and 2011.[24] In developed countries, where fixed-broadband services have been much more affordable, prices have also come down over the last four years, but at a much more moderate rate.

Chart 3.5: Fixed-broadband sub-basket (left) and annual change (right), 2008-2011





Source: ITU.
Note: Based on simple averages.

Box 3.3: Making broadband affordable – A target set by the Broadband Commission for Digital Development

In 2011, the Broadband Commission for Digital Development, a UN-led initiative to promote the importance and use of broadband for achieving development, agreed on a set of four 'ambitious but achievable' targets that countries around the world should strive to meet by the year 2015 in order to ensure their populations can participate fully in the emerging knowledge society (see Chapter 1).[25] One of the four targets, which also cover broadband policy and uptake, refers to broadband prices and calls upon countries to make broadband affordable.

Specifically, the target is that, by 2015, entry-level broadband services should be made affordable in developing countries and amount to less than 5 per cent of average monthly GNI per capita. ITU's fixed-broadband sub-basket, which is used to track this target, shows that while in 2008 only about one-third of all developing countries (included in the IPB) had reached the Broadband Commission target, by 2011 almost 50 per cent of developing countries had attained it. While this points to the progress that has been made in bringing down fixed-broadband prices, the 2010 to 2011 comparison also cautions that relatively little progress was made in the last year. Nevertheless, fixed-broadband prices are still falling in developing countries. For example, while in 2010 a total of 44 countries had fixed-broadband sub-basket values of above eight, this number had decreased to 41 countries by 2011, suggesting that more and more countries are closer to reaching the target.

Source: ITU and Broadband Commission for Digital Development.

Between 2008 and 2009 and 2009 and 2010, prices fell by 19.1 and 17 per cent, respectively, and actually increased slightly (by 1.4 per cent) between 2010 and 2011. As will be discussed further on in this chapter, this price increase usually reflects higher speeds and a greater download volume allowance for fixed-broadband services. The fact that the price for fixed-broadband services in developed countries has ceased to decrease suggests that a high degree of competition has stabilized prices at a relatively low rate.

A comparison of fixed-broadband prices over time also shows that more and more developing countries are able to offer fixed-broadband services at affordable rates. By 2011, almost half of all developing countries included in the IPB had achieved a fixed-broadband sub-basket value of less than 5 per cent of GNI per capita, a target set by the Broadband Commission for Digital Development (Box 3.3).

Results of the 2011 ICT Price Basket and changes from 2010[26]

The 2011 IPB, which ranks a total of 161 economies according to affordability of ICT services, shows that IPB values range from a low (i.e. relatively affordable) 0.3 in Macao (China) to a high (and relatively unaffordable) 64.6 in Madagascar. Besides confirming that there are major differences in ICT prices between countries in the world, the IPB also shows that the countries with highest income levels have the most affordable ICT services. ICT services tend to remain unaffordable in many low-income, developing economies, and particularly in the world's least developed countries (LDCs) (Table 3.1).

The countries ranking at the top of IPB, in particular, are economies with very high monthly GNI per capita levels (Table 3.1). This is of course partly due to the fact that the IPB is calculated as a percentage of GNI per capita. Indeed, all economies with average annual per capita incomes of above USD 50 000 – including Norway, Qatar, Luxembourg, Denmark and Sweden – rank in the top ten of the IPB. Nevertheless, Macao (China), with a lower GNI per capita, ranks first on the 2011 IPB, and its IPB represents as little as 0.3 per cent of GNI per capita. The top-ten list is dominated by economies from Europe and Asia and the Pacific, but also includes Qatar, United Arab Emirates and the United States, which rank fourth, sixth and tenth, respectively. Besides analysing countries in terms of their rank, this chapter will also highlight those countries that feature above or below what their GNI per capita levels would predict.

A total of 30 economies, including Bahrain, Iceland, Israel, Canada, United Kingdom, Japan, France, Australia and

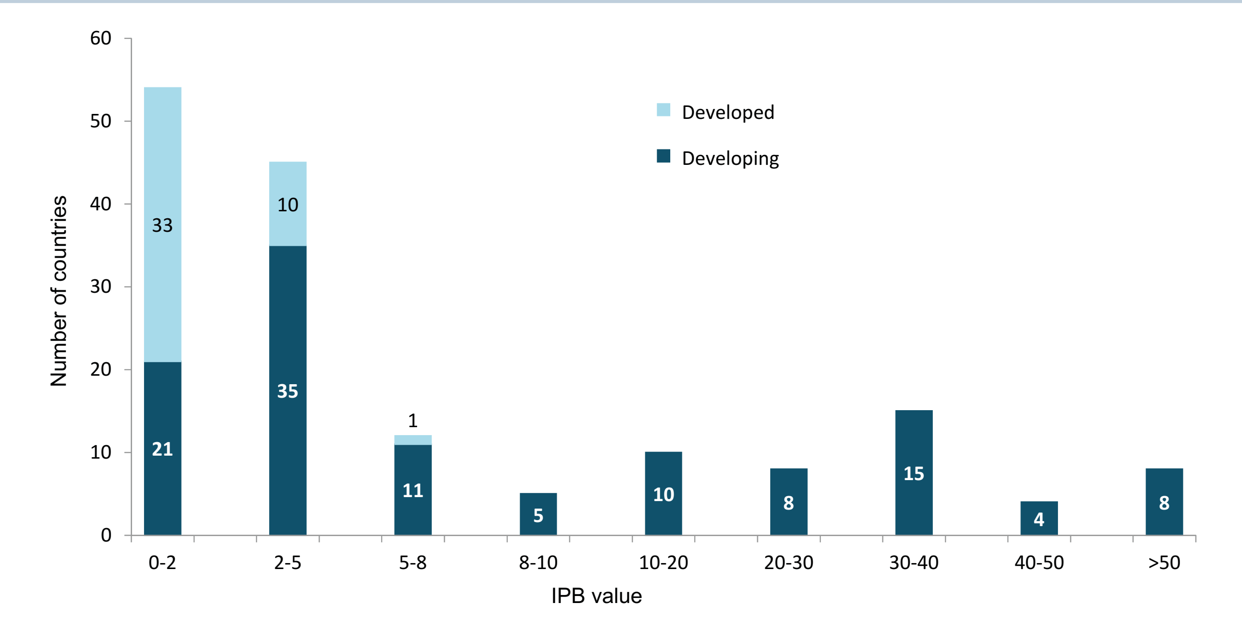
Oman, have IPB values of 1 per cent or less of monthly GNI per capita. A total of 57 economies (more than one-third of all economies included in the IPB), including the Russian Federation, the Republic of Korea, Maldives, Venezuela, New Zealand, Azerbaijan and Uruguay, have IPB values of two or less. This finding suggests that for these economies basic ICT services have become relatively affordable. It also shows that many countries ranked at the top of the IPB have similar values and that differences in rank reflect relatively minor differences in affordability of services. A comparison between ICT prices and ICT uptake further indicates that, in countries where prices have become relatively affordable, a small difference in the IPB (i.e. in prices) will have only a limited impact on ICT uptake. For example, while the Republic of Korea ranks first on the IDI (see Chapter 2), it ranks 'only' 32nd on the IPB, with a (still rather low) IPB value of 1.1.

The link between development status and the affordability of ICT services is highlighted in Chart 3.6, which shows the following:

- In 43 out of 44 developed economies included in the 2011 IPB, the basket represents less than 5 per cent of monthly GNI per capita.
- In 33 developed countries, the IPB value represents less than 2 per cent of monthly GNI per capita.
- By 2011, still more than half of all developing economies (61 out of 117) have IPB values that correspond to more than 5 per cent of average monthly GNI per capita.

Plotting the IPB value against countries' per capita income levels confirms that there is a strong link between national income and the affordability of ICT services. A regression analysis comparing the GNI per capita level with the IPB value shows an R-squared value of 0.84, confirming that relatively high-income countries pay relatively little for ICT services, while low-income economies pay relatively high prices.[27] Notwithstanding the general pattern that high-income countries have relatively low prices and vice-versa, a number of countries stand out for offering relatively affordable ICT services despite lower income levels. These countries lie below the trend line, and include Bangladesh, India, Sri Lanka and Ukraine. Conversely, a number of others stand out for having relatively high IPB values, above what their income levels may predict (above the trend line), including, Cuba, Namibia, Swaziland, Timor Leste and Vanuatu (Chart 3.7).

Chart 3.6: ICT Price Basket by level of development, 2011



Source: ITU.

Table 3.1: ICT Price Basket and sub-baskets, 2011 and 2010

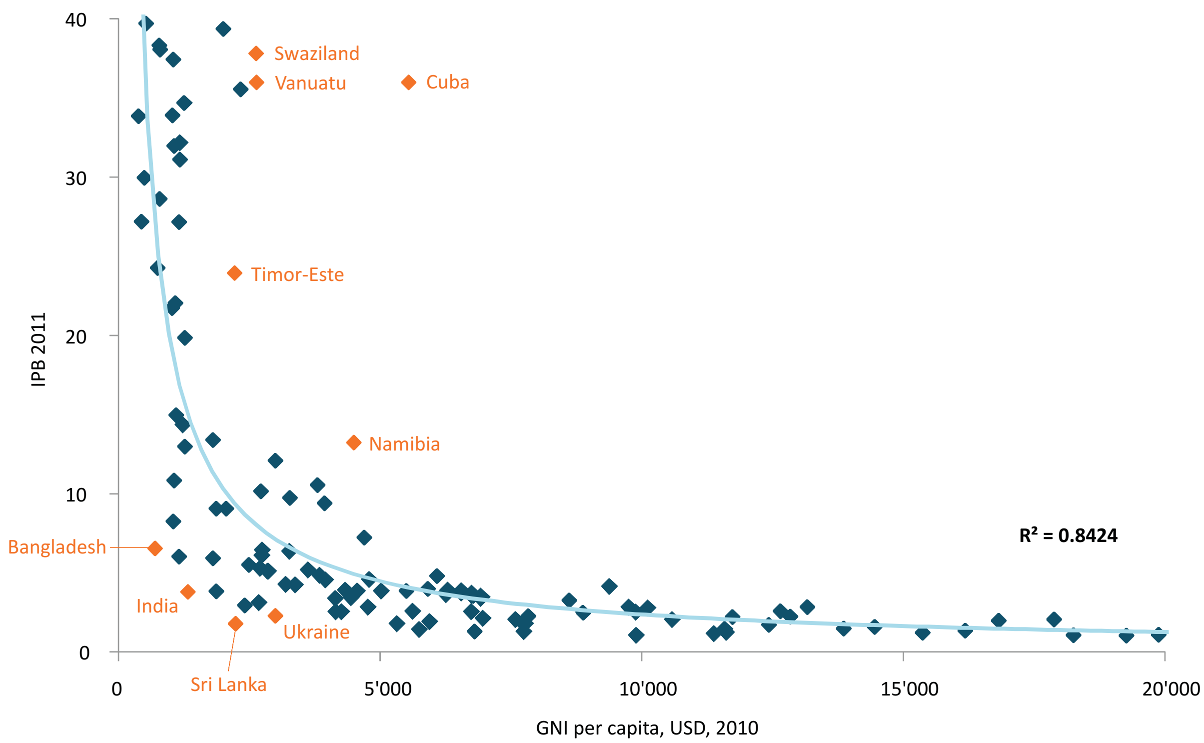
Rank	Economy	IPB		Fixed-telephone sub-basket as a % of GNI per capita		Mobile-cellular sub-basket as a % of GNI per capita		Fixed-broadband sub-basket as a % of GNI per capita		GNI per capita, USD, 2010 (or latest available year)
		2011	2010	2011	2010	2011	2010	2011	2010	
1	Macao, China	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	34’880
2	Norway	0.4	0.5	0.3	0.5	0.2	0.2	0.7	0.7	84’290
3	Singapore	0.4	0.4	0.2	0.2	0.2	0.2	0.8	0.8	40’070
4	Qatar	0.5	0.5	0.2	0.2	0.3	0.3	0.9	0.9	71’008
5	Luxembourg	0.5	0.5	0.4	0.4	0.4	0.4	0.6	0.6	77’160
6	United Arab Emirates	0.5	0.5	0.1	0.1	0.3	0.2	1.2	1.2	41’930
7	Denmark	0.5	0.5	0.6	0.6	0.2	0.2	0.9	0.9	59’050
8	Hong Kong, China	0.6	0.5	0.5	0.5	0.4	0.4	0.8	0.7	32’780
9	Sweden	0.6	0.6	0.6	0.6	0.3	0.3	0.8	0.8	50’110
10	United States	0.6	0.6	0.3	0.3	0.9	0.9	0.5	0.5	47’390
11	Switzerland	0.6	0.6	0.5	0.5	0.8	0.8	0.5	0.5	71’530
12	Finland	0.6	0.5	0.6	0.4	0.3	0.3	0.9	0.9	47’720
13	Austria	0.7	0.7	0.6	0.6	0.3	0.4	1.0	1.0	47’060
14	Cyprus	0.7	0.9	1.0	1.0	0.3	0.3	0.8	1.4	29’430
15	Bahrain	0.7	0.7	0.2	0.2	0.7	0.7	1.3	1.3	25’420
16	Iceland	0.8	0.7	0.7	0.6	0.7	0.6	1.0	0.9	32’710
17	Netherlands	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	49’050
18	Belgium	0.8	0.8	0.8	0.8	1.0	1.1	0.7	0.6	45’910
19	Israel	0.9	0.9	0.8	0.7	1.5	1.5	0.4	0.4	27’170
20	Germany	0.9	0.8	0.8	0.8	0.9	0.6	1.1	1.1	43’110
21	Ireland	0.9	0.9	0.8	0.8	1.1	1.1	1.0	1.0	41’000
22	Canada	0.9	0.8	0.8	0.6	1.2	1.1	0.8	0.7	43’270
23	Italy	0.9	0.9	0.9	0.9	1.1	1.0	0.9	0.9	35’150
24	United Kingdom	0.9	0.9	1.0	0.8	1.2	1.1	0.6	0.8	38’370
25	Japan	1.0	1.0	0.8	0.8	1.4	1.5	0.7	0.7	41’850
26	Brunei Darussalam	1.0	1.0	0.4	0.4	0.7	0.7	1.8	1.9	31’800
27	France	1.0	1.0	0.8	0.8	1.4	1.4	0.9	0.9	42’390
28	Malta	1.0	1.0	0.7	0.6	1.3	1.3	1.1	1.1	19’270
29	Australia	1.0	0.8	0.8	0.8	0.8	0.8	1.5	1.0	43’590
30	Oman	1.0	1.2	0.9	0.9	0.6	0.6	1.7	2.2	18’260
31	Russian Federation	1.1	1.0	0.8	0.8	1.1	1.1	1.2	1.2	9’900
32	Korea (Rep.)	1.1	1.1	0.4	0.4	1.3	1.4	1.6	1.6	19’890
33	Lithuania	1.2	1.2	1.4	1.4	1.0	1.0	1.1	1.1	11’390
34	Greece	1.2	1.2	1.1	1.1	1.6	1.7	0.9	0.8	26’940
35	Trinidad & Tobago	1.2	1.2	1.5	1.5	1.1	1.1	1.0	1.0	15’380
36	Latvia	1.2	1.2	1.0	1.0	1.3	1.3	1.3	1.3	11’620
37	Bahamas	1.2	1.3	0.9	0.9	1.0	1.0	1.7	2.0	20’610
38	Slovenia	1.3	1.2	0.9	0.9	1.2	1.0	1.7	1.7	23’860
39	Mauritius	1.3	1.5	0.8	0.8	1.0	1.1	2.0	2.5	7’750
40	Costa Rica	1.3	1.5	0.8	1.2	0.6	0.6	2.5	2.6	6’810
41	Saudi Arabia	1.3	1.3	1.0	0.7	1.0	1.1	2.0	2.0	16’190
42	Portugal	1.4	1.4	1.3	1.4	1.3	1.3	1.5	1.4	21’880
43	Spain	1.4	1.3	1.2	1.1	1.8	1.8	1.2	1.2	31’750
44	Maldives	1.4	1.4	0.8	0.8	1.4	1.4	1.9	1.9	5’750
45	Venezuela	1.4	1.3	0.2	0.2	2.5	2.3	1.6	1.5	11’590
46	Croatia	1.5	1.5	1.5	1.5	1.3	1.5	1.6	1.6	13’870
47	Estonia	1.6	1.5	1.0	1.0	1.9	1.9	1.7	1.7	14’460
48	New Zealand	1.7	1.6	1.4	1.4	2.0	2.0	1.7	1.5	28’770
49	Poland	1.7	1.7	2.0	2.0	1.2	1.5	1.9	1.7	12’440
50	Sri Lanka	1.8	1.8	1.8	1.8	0.6	1.0	2.9	2.7	2’240
51	Malaysia	1.8	1.8	0.8	0.8	1.4	1.4	3.2	3.2	7’760
52	Azerbaijan	1.8	1.7	0.6	0.6	2.0	1.7	2.8	2.8	5’330
53	Belarus	1.9	1.8	0.3	0.3	1.8	1.6	3.6	3.6	5’950
54	Slovakia	2.0	2.0	1.3	1.3	2.7	2.7	1.9	1.8	16’830
55	Uruguay	2.0	2.0	1.5	1.5	2.4	2.4	2.2	2.2	10’590
56	Czech Republic	2.0	1.9	1.8	1.8	2.2	1.9	2.1	2.1	17’890
57	Kazakhstan	2.0	1.6	0.4	0.4	1.9	2.3	3.8	2.1	7’590
58	Panama	2.1	2.2	2.2	2.1	1.6	1.7	2.5	2.9	6’970
59	St. Kitts and Nevis	2.2	2.2	1.3	1.2	1.5	1.6	3.7	3.7	11’740
60	Hungary	2.2	2.2	2.1	2.0	2.6	2.6	2.0	1.9	12’850
61	Romania	2.2	2.2	1.9	1.7	3.4	3.3	1.4	1.4	7’840
62	Ukraine	2.3	2.3	1.2	1.2	2.6	2.6	3.0	3.0	3’000
63	Mexico	2.4	2.4	2.6	2.6	2.3	2.3	2.5	2.3	8’890
64	Lebanon	2.5	3.0	1.6	1.4	3.4	4.1	2.4	3.4	8’880
65	Turkey	2.5	3.2	1.8	2.0	4.1	5.3	1.7	2.3	9’890
66	Tunisia	2.5	2.2	1.7	0.7	2.9	2.9	3.0	3.0	4’160
67	China	2.5	2.7	1.1	1.3	1.5	1.7	5.0	5.0	4’270
68	Montenegro	2.5	2.6	1.4	1.6	2.9	2.9	3.3	3.3	6’750
69	Serbia	2.6	2.1	1.4	1.1	2.1	1.8	4.2	3.3	5’630
70	Barbados	2.6	2.5	2.0	1.9	2.0	1.9	3.8	3.7	12’660
71	Chile	2.8	3.5	3.2	3.0	2.8	2.8	2.3	4.7	10’120
72	Seychelles	2.8	3.0	1.2	1.1	2.1	2.0	5.1	5.9	9’760
73	Bosnia and Herzegovina	2.8	3.2	2.5	2.3	4.0	3.9	2.0	3.4	4’770
74	Antigua & Barbuda	2.8	2.8	1.2	1.3	2.3	2.0	5.0	5.2	13’170
75	Egypt	2.9	3.0	1.6	1.6	3.3	3.5	4.0	4.0	2’420
76	Georgia	3.1	3.3	1.0	1.0	4.6	5.2	3.8	3.8	2’690
77	Argentina	3.2	2.8	0.6	0.6	5.7	4.3	3.4	3.6	8’620
78	Thailand	3.4	3.5	1.7	2.6	2.5	2.5	5.8	5.5	4’150
79	Algeria	3.4	3.1	1.7	1.7	3.7	3.7	4.8	4.0	4’450
80	Grenada	3.5	3.4	2.3	2.1	3.0	2.9	5.1	5.1	6’930
81	Botswana	3.5	3.7	3.0	3.3	2.3	2.6	5.2	5.2	6’790

Table 3.1: ICT Price Basket and sub-baskets, 2011 and 2010 (continued)

Rank	Economy	IPB		Fixed-telephone sub-basket as a % of GNI per capita		Mobile-cellular sub-basket as a % of GNI per capita		Fixed-broadband sub-basket as a % of GNI per capita		GNI per capita, USD, 2010 (or latest available year)
		2011	2010	2011	2010	2011	2010	2011	2010	
82	Dominica	3.6	4.4	1.9	1.9	3.1	3.0	5.9	8.5	6'760
83	Bulgaria	3.7	3.8	2.2	2.4	6.3	6.3	2.6	2.6	6'270
84	Saint Lucia	3.8	3.8	2.1	2.1	3.9	4.1	5.4	5.4	6'560
85	India	3.8	3.9	2.7	2.7	3.2	3.5	5.5	5.5	1'330
86	Bhutan	3.8	3.9	2.2	2.2	2.3	2.9	7.0	6.7	1'870
87	Colombia	3.8	4.6	1.5	1.3	4.8	4.8	5.2	7.7	5'510
88	TFYR Macedonia	3.8	4.2	3.1	3.1	5.0	6.1	3.4	3.4	4'570
89	Dominican Rep.	3.8	4.1	3.0	3.7	4.0	4.0	4.5	4.5	5'030
90	St. Vincent and the Grenadines	3.9	3.9	2.1	2.1	3.2	3.2	6.4	6.4	6'300
91	Jordan	3.9	4.6	2.6	2.6	2.9	2.9	6.2	8.3	4'340
92	Suriname	4.0	4.0	0.5	0.5	2.9	2.9	8.5	8.5	5'920
93	Brazil	4.1	4.7	2.9	2.9	7.3	7.3	2.2	4.0	9'390
94	El Salvador	4.2	5.3	2.4	2.5	4.7	4.5	5.6	8.8	3'380
95	Armenia	4.3	5.7	1.6	1.6	3.3	3.3	7.9	12.1	3'200
96	Albania	4.6	4.3	2.3	1.9	7.8	7.8	3.5	3.3	3'960
97	Jamaica	4.6	4.4	3.2	2.9	3.2	3.0	7.3	7.3	4'800
98	South Africa	4.8	5.0	4.6	4.9	4.4	4.6	5.4	5.4	6'090
99	Ecuador	4.8	4.8	2.2	2.2	5.3	5.3	7.0	7.0	3'850
100	Morocco	5.1	9.3	0.9	9.0	9.4	13.9	4.9	4.9	2'850
101	Guyana	5.1	8.3	1.3	1.3	3.5	3.9	10.4	19.6	2'870
102	Fiji	5.2	4.9	2.8	2.6	6.5	6.2	6.2	6.1	3'630
103	Paraguay	5.3	5.1	3.0	3.0	4.3	3.8	8.5	8.4	2'710
104	Indonesia	5.5	5.5	2.2	2.4	3.9	3.8	10.4	10.4	2'500
105	Moldova	5.9	5.9	1.3	1.3	8.4	8.4	8.1	8.1	1'810
106	Viet Nam	6.0	6.4	2.3	2.5	4.9	5.8	10.8	10.8	1'160
107	Guatemala	6.1	6.7	2.4	2.4	3.9	3.4	12.0	14.2	2'740
108	Cape Verde	6.3	8.7	3.1	3.1	11.6	11.6	4.3	11.6	3'270
109	Syria	6.4	6.2	0.5	0.5	9.3	8.7	9.4	9.4	2'750
110	Bangladesh	6.5	6.8	2.6	2.3	2.7	4.0	14.3	14.3	700
111	Peru	7.2	8.5	3.1	3.6	11.0	11.0	7.6	10.8	4'700
112	Pakistan	8.2	8.0	4.7	4.3	3.8	3.4	16.2	16.2	1'050
113	Philippines	9.0	9.2	8.4	8.9	5.9	5.9	12.9	12.9	2'060
114	Honduras	9.0	9.1	4.1	4.1	10.9	9.1	12.2	14.1	1'870
115	Angola	9.4	17.2	5.3	5.0	6.3	5.9	16.5	40.6	3'940
116	Tonga	9.7	8.7	2.3	2.3	4.0	4.0	22.8	19.8	3'280
117	Micronesia	10.1	8.6	4.4	4.1	4.0	4.0	22.0	17.6	2'730
118	Belize	10.5	15.8	6.2	6.2	9.8	9.8	15.6	31.5	3'810
119	Yemen	10.8	10.3	1.1	1.2	12.6	11.0	18.7	18.7	1'070
120	Samoa	12.1	12.0	4.8	4.8	7.1	7.1	24.3	24.3	3'000
121	Sudan	12.9	N/A	5.7	N/A	5.7	N/A	27.4	N/A	1'270
122	Namibia	13.2	13.4	3.8	4.0	4.3	4.5	31.6	31.6	4'500
123	Bolivia	13.4	15.5	15.7	15.7	7.5	7.5	16.9	23.2	1'810
124	Ghana	14.3	14.6	5.4	5.4	6.9	7.5	30.8	30.8	1'230
125	Nicaragua	14.9	20.4	5.6	5.6	18.1	18.3	21.1	37.2	1'110
126	Djibouti	19.8	25.5	7.6	7.8	12.3	12.3	39.5	56.4	1'270
127	Mauritania	21.7	22.5	20.9	20.9	16.8	19.1	27.4	27.4	1'030
128	Senegal	22.0	22.0	11.3	11.3	15.1	15.1	39.7	39.7	1'090
129	Timor-Leste	23.9	24.1	9.3	10.0	9.0	8.7	53.5	53.5	2'220
130	Cambodia	24.3	32.0	12.6	11.7	12.1	12.4	48.0	72.0	750
131	Côte d'Ivoire	27.1	26.1	20.3	20.3	19.7	16.7	41.5	41.5	1'160
132	Nepal	27.2	26.6	9.3	8.5	8.7	7.8	63.4	63.4	440
133	Kenya	28.6	32.3	21.5	21.5	6.8	17.8	57.4	57.6	790
134	Uganda	29.9	32.3	25.7	25.9	25.1	32.0	39.0	39.0	500
135	Nigeria	31.1	28.0	16.4	14.2	16.1	15.7	60.7	54.0	1'180
136	Zambia	32.0	37.0	8.4	27.0	22.4	18.9	65.0	65.0	1'070
137	Cameroon	32.2	39.9	18.2	18.2	19.1	19.9	59.1	81.5	1'180
138	Ethiopia	33.8	38.5	3.4	3.0	13.0	12.6	85.0	906.0	390
139	Lesotho	33.9	33.9	15.0	15.0	25.4	27.9	61.2	58.8	1'040
140	Uzbekistan	34.7	34.6	0.8	1.0	3.2	2.8	187.5	187.5	1'280
141	Iraq	35.5	N/A	0.2	N/A	6.4	N/A	108.3	N/A	2'340
142	Cuba	36.0	35.8	0.1	0.1	7.8	7.3	379.0	379.0	5'550
143	Vanuatu	36.0	35.7	18.6	18.6	11.6	10.6	77.7	77.7	2'640
144	Lao P.D.R.	37.4	37.3	5.2	4.6	7.0	7.2	111.0	159.6	1'050
145	Swaziland	37.8	38.0	2.3	2.3	11.1	11.7	399.1	399.1	2'630
146	Tajikistan	38.0	37.8	1.4	1.3	12.7	12.2	543.7	543.7	800
147	Benin	38.3	38.3	13.9	13.9	23.9	23.9	77.1	77.1	780
148	Kiribati	39.4	39.5	6.9	6.9	11.2	11.7	228.7	228.7	2'010
149	Tanzania	39.7	44.4	25.5	25.5	22.9	37.1	70.8	70.8	530
150	S. Tomé & Principe	40.3	40.3	8.3	8.3	12.7	12.7	221.3	285.4	1'200
151	Gambia	41.8	N/A	9.3	N/A	16.0	N/A	747.4	N/A	450
152	Comoros	45.9	51.6	16.0	16.0	21.6	38.8	128.3	620.0	750
153	Mali	46.6	50.3	15.7	17.0	29.3	33.9	94.6	100.2	600
154	Rwanda	51.6	55.0	20.8	28.3	34.0	36.7	257.8	377.4	520
155	Eritrea	51.8	N/A	12.7	N/A	42.8	N/A	720.0	N/A	340
156	Burkina Faso	51.8	58.4	30.3	28.0	25.2	47.3	113.5	180.1	550
157	Zimbabwe	52.8	59.0	26.3	23.6	53.7	53.4	78.3	1059.0	460
158	Mozambique	57.8	60.0	31.4	33.7	41.9	46.2	135.5	135.5	440
159	Togo	60.5	61.5	33.5	33.5	48.0	51.2	405.5	405.5	490
160	Niger	64.0	73.9	37.9	37.9	54.0	83.7	193.4	193.4	370
161	Madagascar	64.6	64.6	50.9	50.9	43.1	43.1	106.9	253.0	430

Source: ITU. GNI per capita and PPP$ values are based on World Bank data.
Note: N/A – Not available.

Chart 3.7: Relationship between the ICT Price Basket values and GNI per capita



Source: ITU.
Note: Includes all countries with a maximum IPB value of 40 and maximum GNI per capita of 20 000.

Table 3.1 compares the IPB and sub-basket values between 2010 and 2011. Given the relatively low IPB values for most of the economies at the top of the list, the changes for those (mostly high-income) economies remain relatively small. Less than one-third of the countries ranked in the top 50 of the 2011 IPB show any change in their value, and in most cases changes are minor. Only one country – Oman – decreased its IPB value by over 15 per cent, from 1.2 to 1, due to a big drop in fixed-broadband prices in 2011.

The most significant IPB value changes took place in countries where prices still remain relatively high. In Turkey, Chile, Armenia, Nicaragua and Cambodia, for example, the IPB value decreased by over 25 per cent, usually due to a sizeable price reduction in fixed-broadband prices. In Angola, the drop in fixed-broadband prices reduced the IPB value by over 80 per cent, as did the reduction in fixed-telephone and mobile-cellular prices in Morocco. The more dynamic changes at the lower end of the IPB ranking compared to those at the top suggest that countries with ICT prices that are already relatively low have less scope for further cutting prices, whereas more can be done in countries where prices remain relatively high.

IPB sub-basket results and analysis

Fixed-telephone sub-basket

The 2011 fixed-telephone sub-basket ranges from 0.1 per cent of GNI per capita in Cuba to 50.9 in Madagascar, although in the large majority of countries (124 out of 161) the price of a monthly subscription and 30 local calls represents less than 5 per cent of average monthly GNI per capita. In around 10 per cent of all countries included in the IPB it represents more than 20 per cent of GNI per capita (see Table 3.2). As highlighted in section 3.2, the fixed-telephone sub-basket has registered the most moderate price change over the last years, and between 2010 and 2011 the fixed-

telephone sub-basket actually increased in developed countries, albeit only slightly.

In comparison with the IPB and the other two sub-baskets, the link between countries' income levels and their fixed-telephone sub-basket ranking is weaker, as shown by an R-squared value of 0.60, which is lower than for the two other sub-baskets.[28]

The list of countries where fixed-telephone services are most affordable is very diverse in terms of development, income levels and region. The top-ten countries include Cuba, United Arab Emirates, Venezuela, Bahrain, Singapore and Norway. At the bottom of the list, the fixed-telephone sub-basket is not that different from the other sub-baskets, insofar as fixed telephony is least affordable in some of the world's poorest countries, including Niger, Togo, Mozambique and Burkina Faso (Table 3.2).

For the majority of countries, fixed-telephone prices have not changed between 2010 and 2011, and where they have changed one observes both increases and decreases. In countries where prices have significantly dropped or increased, this is often because operators have modified the pricing structure for fixed-telephone services. For example, in a number of European countries, including Finland and United Kingdom, the monthly subscription price as well as the per-minute call prices – which do not take into account the growing quantity of bundled offers – have increased. Similarly, in Canada, where the fixed monthly subscription comes with unlimited local calls, fixed telephony is more expensive than in the previous year, since the cheaper offer exists only for customers that add a bundled offer including other services (TV, Internet, etc.). In some countries, operators apply different prices to new customers only. In Saudi Arabia, for example, the monthly subscription remains the same for all existing customers, but was substantially increased (by 50 per cent) for all new customers. In Tunisia, the fixed-telephone billing structure has been completely reviewed by Tunisie Telecom. While a distinction was previously made between (relatively cheap) local calls and (more expensive) national trunk and long-distance calls, the price is now the same for all national calls, effectively making local calls much more expensive (up from USD 0.02 to 0.10 for a three-minute call) and pushing up the fixed-telephone sub-basket.

Similarly, price drops often reflect a change in the way operators offer their services, for example by introducing new packages. In other cases, they reflect a change in the operator that is used, if market shares have shifted. Morocco's fixed-telephone sub-basket value decreased substantially in 2011 in relation to previous years. This stems from a change in the operator and package chosen. In 2011, the large majority of fixed-telephone customers subscribed to the Inwi/Wana prepaid package,[29] which corresponds to the exact amount of minutes included in the fixed-telephone sub-basket. Prior to that, the fixed-telephone sub-basket for Morocco had been based on Maroc Telecom's postpaid service, which had a relatively high monthly subscription fee, and no free minutes included.

Mobile-cellular sub-basket

The 2011 mobile-cellular sub-basket varies from 0.2 per cent of GNI per capita in Denmark to 54 per cent in Niger, highlighting that the affordability of basic mobile-cellular services varies greatly between countries. Countries with the relatively cheapest mobile-cellular prices also tend to have highly competitive markets that have not only initiated privatization and full liberalization but also taken liberalization and competition much further, for example through such regulatory mechanisms as mobile number portability (MNP) (see Box 3.4) and the introduction of mobile virtual network operators (MVNO). There is a strong link between countries' income levels and the mobile-cellular sub-basket, and a regression analysis comparing GNI per capita levels to the mobile-cellular sub-basket indicates an R-squared value of 0.77.[30]

The top-ten countries with the most affordable mobile-cellular sub-baskets are all high-income economies and include six European countries, including the Nordic countries of Denmark, Norway and Sweden, but also Macao (China), Singapore, United Arab Emirates and Qatar. The countries with the relatively most expensive mobile-cellular services, on the other hand, are all low-income developing countries, including Niger, Zimbabwe, Togo, Eritrea, Mali and Benin. Twenty-four out of 25 countries at the bottom of the mobile-cellular sub-basket are from Africa (Table 3.3).

As highlighted in section 3.2, mobile-cellular prices have decreased substantially over the last few years. While between

Table 3.2: Fixed-telephone sub-basket, 2011 and 2010

Rank	Economy	Fixed-telephone sub-basket as % of GNI per capita		Value change	Relative change (%)	Fixed-telephone sub-basket, USD	Fixed-telephone sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
		2011	2010	2010-2011				
1	Cuba	0.1	0.1	0.0	12	0.3	N/A	5'550
2	United Arab Emirates	0.1	0.1	0.0	0	4.1	4.9	41'930
3	Qatar	0.2	0.2	0.0	0	9.1	11.9	71'008
4	Venezuela	0.2	0.2	0.0	1	1.7	2.5	11'590
5	Iraq	0.2	N/A	N/A	N/A	0.4	0.5	2'340
6	Bahrain	0.2	0.2	0.0	-2	4.7	5.9	25'420
7	Singapore	0.2	0.2	0.0	0	8.2	10.7	40'070
8	Belarus	0.3	0.3	0.0	5	1.3	3.2	5'950
9	Macao, China	0.3	0.3	0.0	0	8.4	10.4	34'880
10	Norway	0.3	0.5	-0.1	-27	23.8	16.1	84'290
11	United States	0.3	0.3	0.0	8	13.8	13.8	47'390
12	Korea (Rep.)	0.4	0.4	0.0	0	5.8	8.2	19'890
13	Luxembourg	0.4	0.4	0.0	0	26.9	22.4	77'160
14	Kazakhstan	0.4	0.4	0.1	17	2.7	3.7	7'590
15	Brunei Darussalam	0.4	0.4	0.0	0	11.7	19.7	31'800
16	Suriname	0.5	0.5	0.0	0	2.5	3.1	5'920
17	Hong Kong, China	0.5	0.5	0.0	0	14.2	20.7	32'780
18	Switzerland	0.5	0.5	0.0	7	31.6	21.7	71'530
19	Syria	0.5	0.5	0.0	0	1.3	2.3	2'750
20	Azerbaijan	0.6	0.6	0.0	0	2.5	4.3	5'330
21	Denmark	0.6	0.6	0.0	4	28.9	20.6	59'050
22	Sweden	0.6	0.6	0.0	0	25.5	20.3	50'110
23	Argentina	0.6	0.6	0.0	0	4.6	8.1	8'620
24	Finland	0.6	0.4	0.2	51	25.5	21.2	47'720
25	Austria	0.6	0.6	0.0	0	25.3	22.6	47'060
26	Malta	0.7	0.6	0.0	1	10.4	14.0	19'270
27	Iceland	0.7	0.6	0.1	15	19.0	16.8	32'710
28	France	0.8	0.8	0.0	0	26.6	22.9	42'390
29	Germany	0.8	0.8	0.0	0	27.2	25.4	43'110
30	Japan	0.8	0.8	0.0	0	26.4	20.8	41'850
31	Canada	0.8	0.6	0.2	25	27.3	23.1	43'270
32	Israel	0.8	0.7	0.1	11	17.4	17.3	27'170
33	Ireland	0.8	0.8	0.0	0	26.3	23.1	41'000
34	Netherlands	0.8	0.7	0.0	6	32.5	29.5	49'050
35	Mauritius	0.8	0.8	0.0	0	5.1	9.2	7'750
36	Malaysia	0.8	0.8	0.0	0	5.1	9.1	7'760
37	Australia	0.8	0.8	0.1	7	29.5	21.1	43'590
38	Costa Rica	0.8	1.2	-0.4	-33	4.6	6.9	6'810
39	Uzbekistan	0.8	1.0	-0.2	-18	0.9	2.0	1'280
40	Belgium	0.8	0.8	0.0	1	31.5	27.7	45'910
41	Maldives	0.8	0.8	0.0	0	4.1	5.8	5'750
42	Russian Federation	0.8	0.8	0.1	13	7.0	13.2	9'900
43	Oman	0.9	0.9	0.0	0	13.1	20.4	18'260
44	Italy	0.9	0.9	0.0	1	25.8	24.2	35'150
45	Slovenia	0.9	0.9	0.0	-1	17.7	21.1	23'860
46	Bahamas	0.9	0.9	0.0	0	16.3	18.8	20'610
47	Morocco	0.9	9.0	-8.0	-89	2.3	3.8	2'850
48	Cyprus	1.0	1.0	0.0	-2	23.4	25.5	29'430
49	Saudi Arabia	1.0	0.7	0.3	43	13.2	18.9	16'190
50	Estonia	1.0	1.0	0.0	4	11.9	N/A	14'460
51	Georgia	1.0	1.0	0.0	0	2.3	4.3	2'690
52	United Kingdom	1.0	0.8	0.3	36	33.1	33.1	38'370
53	Latvia	1.0	1.0	0.0	1	10.1	15.7	11'620
54	Yemen	1.1	1.2	-0.1	-12	0.9	2.3	1'070
55	Greece	1.1	1.1	0.0	0	23.8	25.1	26'940
56	China	1.1	1.3	-0.2	-17	3.9	6.6	4'270
57	Seychelles	1.2	1.1	0.0	3	9.4	19.8	9'760
58	Antigua & Barbuda	1.2	1.3	-0.1	-10	12.8	19.5	13'170
59	Spain	1.2	1.1	0.1	12	31.1	32.9	31'750
60	Ukraine	1.2	1.2	0.0	0	2.9	6.6	3'000
61	Slovakia	1.3	1.3	-0.1	-4	17.9	26.3	16'830
62	St. Kitts and Nevis	1.3	1.2	0.1	9	12.6	16.9	11'740
63	Moldova	1.3	1.3	0.0	0	1.9	3.7	1'810
64	Portugal	1.3	1.4	-0.1	-7	23.6	28.3	21'880
65	Guyana	1.3	1.3	0.0	0	3.1	3.6	2'870
66	Lithuania	1.4	1.4	0.0	-1	12.9	21.7	11'390
67	New Zealand	1.4	1.4	0.0	-3	33.0	30.4	28'770
68	Tajikistan	1.4	1.3	0.1	5	0.9	2.5	800
69	Montenegro	1.4	1.6	-0.2	-14	7.8	15.8	6'750
70	Serbia	1.4	1.1	0.3	22	6.6	14.0	5'630
71	Croatia	1.5	1.5	0.0	0	16.9	23.9	13'870
72	Uruguay	1.5	1.5	0.0	-3	13.0	15.7	10'590
73	Trinidad & Tobago	1.5	1.5	0.0	0	19.5	32.6	15'380
74	Colombia	1.5	1.3	0.2	19	7.1	10.7	5'510
75	Egypt	1.6	1.6	0.0	0	3.1	7.3	2'420
76	Armenia	1.6	1.6	0.0	0	4.2	7.5	3'200
77	Lebanon	1.6	1.4	0.2	14	11.7	17.8	8'880
78	Tunisia	1.7	0.7	0.9	131	5.8	13.1	4'160
79	Algeria	1.7	1.7	0.0	-2	6.3	11.7	4'450
80	Thailand	1.7	2.6	-0.8	-32	6.0	11.1	4'150
81	Turkey	1.8	2.0	-0.3	-13	14.5	22.1	9'890

Table 3.2: Fixed-telephone sub-basket, 2011 and 2010 (continued)

Rank	Economy	Fixed-telephone sub-basket as % of GNI per capita		Value change	Relative change (%)	Fixed-telephone sub-basket, USD	Fixed-telephone sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
		2011	2010	2010-2011				
82	Czech Republic	1.8	1.8	0.0	0	26.8	37.4	17'890
83	Sri Lanka	1.8	1.8	0.0	-2	3.4	7.2	2'240
84	Dominica	1.9	1.9	0.0	0	10.7	19.2	6'760
85	Romania	1.9	1.7	0.2	10	12.5	23.6	7'840
86	Barbados	2.0	1.9	0.0	2	20.7	31.0	12'660
87	Poland	2.0	2.0	0.0	2	20.6	33.4	12'440
88	Hungary	2.1	2.0	0.1	5	22.1	34.8	12'850
89	St. Vincent and the Grenadines	2.1	2.1	0.0	-1	10.9	18.6	6'300
90	Saint Lucia	2.1	2.1	0.0	0	11.6	18.3	6'560
91	Bhutan	2.2	2.2	0.0	0	3.4	8.6	1'870
92	Bulgaria	2.2	2.4	-0.2	-10	11.3	24.8	6'270
93	Ecuador	2.2	2.2	0.0	0	6.9	13.9	3'850
94	Panama	2.2	2.1	0.2	7	12.8	23.5	6'970
95	Indonesia	2.2	2.4	-0.2	-8	4.6	6.8	2'500
96	Viet Nam	2.3	2.5	-0.3	-11	2.2	5.9	1'160
97	Swaziland	2.3	2.3	0.0	0	5.0	8.2	2'630
98	Albania	2.3	1.9	0.4	20	7.6	18.0	3'960
99	Grenada	2.3	2.1	0.2	9	13.4	19.1	6'930
100	Tonga	2.3	2.3	0.0	0	6.4	8.2	3'280
101	Guatemala	2.4	2.4	0.0	0	5.6	9.3	2'740
102	El Salvador	2.4	2.5	0.0	-1	6.9	13.4	3'380
103	Bosnia and Herzegovina	2.5	2.3	0.1	6	9.8	19.3	4'770
104	Mexico	2.6	2.6	0.0	0	18.9	30.1	8'890
105	Jordan	2.6	2.6	0.0	-1	9.4	11.9	4'340
106	Bangladesh	2.6	2.3	0.3	15	1.5	3.8	700
107	India	2.7	2.7	0.0	0	2.9	7.2	1'330
108	Fiji	2.8	2.6	0.2	9	8.5	10.6	3'630
109	Brazil	2.9	2.9	0.0	0	23.0	24.1	9'390
110	Dominican Republic	3.0	3.7	-0.7	-19	12.5	22.4	5'030
111	Paraguay	3.0	3.0	0.0	0	6.8	12.5	2'710
112	Botswana	3.0	3.3	-0.3	-8	17.2	31.9	6'790
113	Cape Verde	3.1	3.1	0.0	0	8.3	10.1	3'270
114	Peru	3.1	3.6	-0.6	-15	12.1	21.2	4'700
115	TFYR Macedonia	3.1	3.1	0.0	0	11.9	29.9	4'570
116	Chile	3.2	3.0	0.2	5	26.6	33.5	10'120
117	Jamaica	3.2	2.9	0.3	12	12.9	19.0	4'800
118	Ethiopia	3.4	3.0	0.4	15	1.1	3.6	390
119	Namibia	3.8	4.0	-0.3	-7	14.1	17.0	4'500
120	Honduras	4.1	4.1	0.0	0	6.3	12.3	1'870
121	Micronesia	4.4	4.1	0.3	7	10.0	12.4	2'730
122	South Africa	4.6	4.9	-0.4	-7	23.2	33.4	6'090
123	Pakistan	4.7	4.3	0.4	9	4.1	10.9	1'050
124	Samoa	4.8	4.8	0.0	1	12.0	16.0	3'000
125	Lao P.D.R.	5.2	4.6	0.6	14	4.6	9.9	1'050
126	Angola	5.3	5.0	0.3	5	17.3	23.8	3'940
127	Ghana	5.4	5.4	0.0	0	5.5	7.0	1'230
128	Nicaragua	5.6	5.6	0.0	0	5.2	13.5	1'110
129	Sudan	5.7	N/A	N/A	N/A	6.0	10.3	1'270
130	Belize	6.2	6.2	0.0	0	19.6	32.3	3'810
131	Kiribati	6.9	6.9	0.0	0	11.5	18.6	2'010
132	Djibouti	7.6	7.8	-0.2	-2	8.1	15.7	1'270
133	S. Tomé & Principe	8.3	8.3	0.0	0	8.3	13.1	1'200
134	Philippines	8.4	8.9	-0.5	-6	14.4	26.7	2'060
135	Zambia	8.4	27.0	-18.6	-69	7.5	9.3	1'070
136	Timor-Leste	9.3	10.0	-0.7	-7	17.2	25.6	2'220
137	Nepal	9.3	8.5	0.8	9	3.4	7.6	440
138	Gambia	9.3	N/A	N/A	N/A	3.5	11.2	450
139	Senegal	11.3	11.3	0.0	0	10.3	19.3	1'090
140	Cambodia	12.6	11.7	1.0	8	7.9	21.7	750
141	Eritrea	12.7	N/A	N/A	N/A	3.6	4.7	340
142	Benin	13.9	13.9	0.0	0	9.0	19.2	780
143	Lesotho	15.0	15.0	0.0	0	13.0	20.3	1'040
144	Bolivia	15.7	15.7	0.0	0	23.7	58.0	1'810
145	Mali	15.7	17.0	-1.3	-8	7.9	14.0	600
146	Comoros	16.0	16.0	0.0	0	10.0	15.0	750
147	Nigeria	16.4	14.2	2.2	15	16.1	31.5	1'180
148	Cameroon	18.2	18.2	0.0	0	17.9	36.1	1'180
149	Vanuatu	18.6	18.6	0.0	0	41.0	61.1	2'640
150	Côte d'Ivoire	20.3	20.3	0.0	0	19.6	32.5	1'160
151	Rwanda	20.8	28.3	-7.5	-27	9.0	19.7	520
152	Mauritania	20.9	20.9	0.0	0	18.0	33.5	1'030
153	Kenya	21.5	21.5	0.0	0	14.2	30.0	790
154	Tanzania	25.5	25.5	0.0	0	11.2	31.2	530
155	Uganda	25.7	25.9	-0.2	-1	10.7	28.6	500
156	Zimbabwe	26.3	23.6	2.7	12	10.1	N/A	460
157	Burkina Faso	30.3	28.0	2.3	8	13.9	32.8	550
158	Mozambique	31.4	33.7	-2.3	-7	11.5	26.7	440
159	Togo	33.5	33.5	0.0	0	13.7	26.2	490
160	Niger	37.9	37.9	0.0	0	11.7	24.0	370
161	Madagascar	50.9	50.9	0.0	0	18.2	41.4	430

Source: ITU. GNI per capita and PPP$ values are based on World Bank data.
Note: N/A: Not available.

Table 3.3: Mobile-cellular sub-basket, 2011 and 2010

Rank	Economy	Mobile-cellular sub-basket as % of GNI per capita		Value change	Relative change (%)	Mobile-cellular sub-basket, USD	Mobile-cellular sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
		2011	2010	2010-2011				
1	Denmark	0.2	0.2	0.0	0	7.9	5.6	59'050
2	Macao, China	0.2	0.2	0.0	0	5.7	7.0	34'880
3	Norway	0.2	0.2	0.0	-15	14.6	9.9	84'290
4	Singapore	0.2	0.2	0.0	0	8.1	10.6	40'070
5	United Arab Emirates	0.3	0.2	0.0	5	9.1	10.8	41'930
6	Qatar	0.3	0.3	0.0	2	18.7	24.6	71'008
7	Cyprus	0.3	0.3	0.0	3	7.9	8.6	29'430
8	Finland	0.3	0.3	0.0	0	13.1	10.9	47'720
9	Austria	0.3	0.4	0.0	-3	13.5	12.0	47'060
10	Sweden	0.3	0.3	0.0	11	14.4	11.5	50'110
11	Hong Kong, China	0.4	0.4	0.0	0	9.8	14.4	32'780
12	Luxembourg	0.4	0.4	0.0	1	26.0	21.6	77'160
13	Oman	0.6	0.6	0.0	-4	8.7	13.5	18'260
14	Sri Lanka	0.6	1.0	-0.4	-43	1.1	2.3	2'240
15	Costa Rica	0.6	0.6	0.0	1	3.4	5.1	6'810
16	Iceland	0.7	0.6	0.0	8	17.9	15.9	32'710
17	Brunei Darussalam	0.7	0.7	0.0	-6	18.3	30.8	31'800
18	Bahrain	0.7	0.7	0.0	0	15.0	18.8	25'420
19	Switzerland	0.8	0.8	0.0	0	45.2	31.2	71'530
20	Australia	0.8	0.8	0.0	0	27.7	19.8	43'590
21	Netherlands	0.8	0.8	0.0	0	33.2	30.1	49'050
22	Germany	0.9	0.6	0.3	41	31.5	29.4	43'110
23	United States	0.9	0.9	0.0	0	35.7	35.7	47'390
24	Belgium	1.0	1.1	-0.1	-7	37.6	33.0	45'910
25	Lithuania	1.0	1.0	0.0	0	9.6	16.1	11'390
26	Bahamas	1.0	1.0	0.0	0	17.5	20.2	20'610
27	Mauritius	1.0	1.1	0.0	-2	6.7	11.9	7'750
28	Saudi Arabia	1.0	1.1	-0.1	-9	14.1	20.3	16'190
29	Italy	1.1	1.0	0.0	4	30.9	29.0	35'150
30	Trinidad & Tobago	1.1	1.1	0.0	0	13.7	23.0	15'380
31	Ireland	1.1	1.1	0.0	0	37.3	32.8	41'000
32	Russian Federation	1.1	1.1	0.0	0	9.2	17.5	9'900
33	United Kingdom	1.2	1.1	0.1	9	38.0	37.9	38'370
34	Slovenia	1.2	1.0	0.2	15	23.9	28.5	23'860
35	Poland	1.2	1.5	-0.3	-20	12.6	20.5	12'440
36	Canada	1.2	1.1	0.2	15	45.0	37.9	43'270
37	Portugal	1.3	1.3	0.0	1	23.2	27.8	21'880
38	Malta	1.3	1.3	0.0	0	20.6	27.6	19'270
39	Latvia	1.3	1.3	0.0	1	12.5	19.3	11'620
40	Korea (Rep.)	1.3	1.4	0.0	-3	21.8	30.7	19'890
41	Croatia	1.3	1.5	-0.1	-9	15.6	22.0	13'870
42	Malaysia	1.4	1.4	0.0	0	8.8	15.5	7'760
43	France	1.4	1.4	0.0	-1	49.2	42.5	42'390
44	Maldives	1.4	1.4	0.0	0	6.8	9.7	5'750
45	Japan	1.4	1.5	-0.1	-5	50.4	39.6	41'850
46	China	1.5	1.7	-0.2	-11	5.3	9.1	4'270
47	Israel	1.5	1.5	0.0	2	34.8	34.6	27'170
48	St. Kitts and Nevis	1.5	1.6	0.0	0	15.1	20.3	11'740
49	Panama	1.6	1.7	-0.1	-7	9.4	17.2	6'970
50	Greece	1.6	1.7	-0.1	-7	36.6	38.5	26'940
51	Belarus	1.8	1.6	0.2	11	8.8	21.4	5'950
52	Spain	1.8	1.8	0.0	0	47.2	49.9	31'750
53	Estonia	1.9	1.9	0.1	4	23.3	N/A	14'460
54	Kazakhstan	1.9	2.3	-0.4	-16	12.2	16.3	7'590
55	New Zealand	2.0	2.0	0.0	0	47.2	43.3	28'770
56	Azerbaijan	2.0	1.7	0.3	20	8.8	15.3	5'330
57	Barbados	2.0	1.9	0.1	6	21.2	31.8	12'660
58	Serbia	2.1	1.8	0.2	13	9.8	20.8	5'630
59	Seychelles	2.1	2.0	0.2	9	17.4	36.5	9'760
60	Czech Republic	2.2	1.9	0.4	19	33.4	46.5	17'890
61	Mexico	2.3	2.3	0.0	-2	17.0	27.0	8'890
62	Antigua & Barbuda	2.3	2.0	0.3	15	25.3	38.6	13'170
63	Bhutan	2.3	2.9	-0.6	-20	3.6	9.2	1'870
64	Botswana	2.3	2.6	-0.3	-10	13.2	24.5	6'790
65	Uruguay	2.4	2.4	0.0	0	21.4	25.8	10'590
66	Thailand	2.5	2.5	0.0	0	8.7	16.2	4'150
67	Venezuela	2.5	2.3	0.2	10	24.6	36.2	11'590
68	Lebanon	2.6	4.1	-1.5	-37	19.0	28.8	8'880
69	Hungary	2.6	2.6	0.0	0	27.6	43.4	12'850
70	Ukraine	2.6	2.6	0.0	0	6.5	14.5	3'000
71	Bangladesh	2.7	4.0	-1.3	-32	1.6	3.9	700
72	Slovakia	2.7	2.7	0.0	1	38.5	56.6	16'830
73	Chile	2.8	2.8	0.0	0	23.7	29.8	10'120
74	Jordan	2.9	2.9	0.0	-1	10.4	13.1	4'340
75	Tunisia	2.9	2.9	0.0	0	10.0	22.6	4'160
76	Suriname	2.9	2.9	0.0	0	14.3	18.1	5'920
77	Montenegro	2.9	2.9	0.0	0	16.5	33.3	6'750
78	Grenada	3.0	2.9	0.1	2	17.1	24.3	6'930
79	Dominica	3.1	3.0	0.2	6	17.7	31.7	6'760
80	India	3.2	3.5	-0.3	-10	3.5	8.6	1'330
81	Uzbekistan	3.2	2.8	0.4	14	3.4	7.7	1'280

Table 3.3: Mobile-cellular sub-basket, 2011 and 2010 (continued)

Rank	Economy	Mobile-cellular sub-basket as % of GNI per capita		Value change	Relative change (%)	Mobile-cellular sub-basket, USD	Mobile-cellular sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
		2011	2010	2010-2011				
82	St. Vincent and the G.	3.2	3.2	0.0	0	16.8	28.8	6'300
83	Jamaica	3.2	3.0	0.2	7	12.9	18.9	4'800
84	Egypt	3.3	3.5	-0.2	-6	6.6	15.4	2'420
85	Armenia	3.3	3.3	0.0	0	8.8	15.8	3'200
86	Romania	3.4	3.3	0.1	2	22.2	42.1	7'840
87	Guyana	3.5	3.9	-0.4	-11	8.4	9.7	2'870
88	Algeria	3.7	3.7	0.0	0	13.8	25.8	4'450
89	Pakistan	3.8	3.4	0.4	12	3.3	8.8	1'050
90	Indonesia	3.9	3.8	0.1	3	8.1	11.8	2'500
91	Saint Lucia	3.9	4.1	-0.2	-5	21.2	33.3	6'560
92	Guatemala	3.9	3.4	0.4	13	8.8	14.8	2'740
93	Bosnia and Herzegovina	4.0	3.9	0.1	3	15.9	31.1	4'770
94	Micronesia	4.0	4.0	0.0	0	9.1	11.3	2'730
95	Tonga	4.0	4.0	0.0	0	11.0	14.1	3'280
96	Dominican Rep.	4.0	4.0	0.0	0	16.9	30.3	5'030
97	Turkey	4.1	5.3	-1.2	-23	33.8	51.6	9'890
98	Namibia	4.3	4.5	-0.3	-6	16.0	19.3	4'500
99	Paraguay	4.3	3.8	0.5	13	9.7	17.8	2'710
100	South Africa	4.4	4.6	-0.2	-4	22.3	32.1	6'090
101	Georgia	4.6	5.2	-0.6	-12	10.2	19.8	2'690
102	El Salvador	4.7	4.5	0.2	4	13.1	25.5	3'380
103	Colombia	4.8	4.8	0.0	0	22.2	33.7	5'510
104	Viet Nam	4.9	5.8	-0.8	-15	4.8	12.8	1'160
105	TFYR Macedonia	5.0	6.1	-1.1	-18	19.1	48.0	4'570
106	Ecuador	5.3	5.3	0.0	0	17.1	34.2	3'850
107	Argentina	5.7	4.3	1.4	34	41.1	71.9	8'620
108	Sudan	5.7	N/A	N/A	N/A	6.1	10.4	1'270
109	Philippines	5.9	5.9	0.0	0	10.1	18.7	2'060
110	Bulgaria	6.3	6.3	0.0	0	32.9	72.2	6'270
111	Angola	6.3	5.9	0.4	8	20.7	28.4	3'940
112	Iraq	6.4	N/A	N/A	N/A	12.5	17.6	2'340
113	Fiji	6.5	6.2	0.3	6	19.8	24.8	3'630
114	Kenya	6.8	17.8	-11.0	-62	4.5	9.5	790
115	Ghana	6.9	7.5	-0.7	-9	7.0	8.9	1'230
116	Lao P.D.R.	7.0	7.2	-0.2	-2	6.2	13.4	1'050
117	Samoa	7.1	7.1	0.0	0	17.6	23.5	3'000
118	Brazil	7.3	7.3	0.0	0	57.2	59.9	9'390
119	Bolivia	7.5	7.5	0.0	0	11.3	27.6	1'810
120	Albania	7.8	7.8	0.0	0	25.8	60.9	3'960
121	Cuba	7.8	7.3	0.5	7	36.3	N/A	5'550
122	Moldova	8.4	8.4	0.0	0	12.6	24.0	1'810
123	Nepal	8.7	7.8	1.0	13	3.2	7.2	440
124	Timor-Leste	9.0	8.7	0.3	3	16.6	24.7	2'220
125	Syria	9.3	8.7	0.6	7	21.3	38.6	2'750
126	Morocco	9.4	13.9	-4.6	-33	22.2	37.6	2'850
127	Belize	9.8	9.8	0.0	0	31.0	51.3	3'810
128	Honduras	10.9	9.1	1.8	20	17.0	32.9	1'870
129	Peru	11.0	11.0	-0.1	-1	42.9	75.5	4'700
130	Swaziland	11.1	11.7	-0.6	-5	24.3	39.8	2'630
131	Kiribati	11.2	11.7	-0.5	-5	18.7	30.2	2'010
132	Vanuatu	11.6	10.6	1.0	9	25.4	37.9	2'640
133	Cape Verde	11.6	11.6	0.1	1	31.7	38.3	3'270
134	Cambodia	12.1	12.4	-0.3	-2	7.6	20.8	750
135	Djibouti	12.3	12.3	0.0	0	13.0	25.3	1'270
136	Yemen	12.6	11.0	1.7	15	11.3	27.2	1'070
137	Tajikistan	12.7	12.2	0.5	4	8.5	22.5	800
138	S. Tomé & Principe	12.7	12.7	0.0	0	12.7	20.1	1'200
139	Ethiopia	13.0	12.6	0.4	3	4.2	13.8	390
140	Senegal	15.1	15.1	0.0	0	13.7	25.8	1'090
141	Gambia	16.0	N/A	N/A	N/A	6.0	19.3	450
142	Nigeria	16.1	15.7	0.5	3	15.9	31.0	1'180
143	Mauritania	16.8	19.1	-2.4	-12	14.4	26.8	1'030
144	Nicaragua	18.1	18.3	-0.2	-1	16.7	43.4	1'110
145	Cameroon	19.1	19.9	-0.8	-4	18.8	37.8	1'180
146	Côte d'Ivoire	19.7	16.7	3.0	18	19.0	31.5	1'160
147	Comoros	21.6	38.8	-17.2	-44	13.5	20.2	750
148	Zambia	22.4	18.9	3.5	18	20.0	24.7	1'070
149	Tanzania	22.9	37.1	-14.2	-38	10.1	28.1	530
150	Benin	23.9	23.9	0.0	0	15.5	33.2	780
151	Uganda	25.1	32.0	-6.9	-22	10.5	28.0	500
152	Burkina Faso	25.2	47.3	-22.1	-47	11.6	27.3	550
153	Lesotho	25.4	27.9	-2.4	-9	22.0	34.4	1'040
154	Mali	29.3	33.9	-4.5	-13	14.7	26.1	600
155	Rwanda	34.0	36.7	-2.7	-7	14.7	32.3	520
156	Mozambique	41.9	46.2	-4.3	-9	15.4	35.6	440
157	Eritrea	42.8	N/A	N/A	N/A	12.1	16.0	340
158	Madagascar	43.1	43.1	0.0	0	15.4	35.1	430
159	Togo	48.0	51.2	-3.2	-6	19.6	37.6	490
160	Zimbabwe	53.7	53.4	0.2	0	20.6	N/A	460
161	Niger	54.0	83.7	-29.8	-36	16.6	34.1	370

Source: ITU. GNI per capita and PPP$ values are based on World Bank data.
Note: N/A: Not available.

Box 3.4: Mobile number portability (MNP)

Mobile number portability (MNP) allows mobile-cellular subscribers to keep their telephone numbers when switching from one operator to another. This option is offered free of charge in some countries, while in others subscribers pay a fee for porting. Advocates of MNP consider it a correctional force in creating a competitive market and customer choice. It has been argued that "number portability is a key element of true competition because many users are reluctant to change operators if that requires changing numbers."[31] In the absence of MNP, high switching costs (such as loss of number, updating of contacts, missed calls) will deter customers from changing operators, and thus prevent operators from gaining market access. In this case, incumbent telecommunication operators hold a competitive advantage with their base of captured customers.

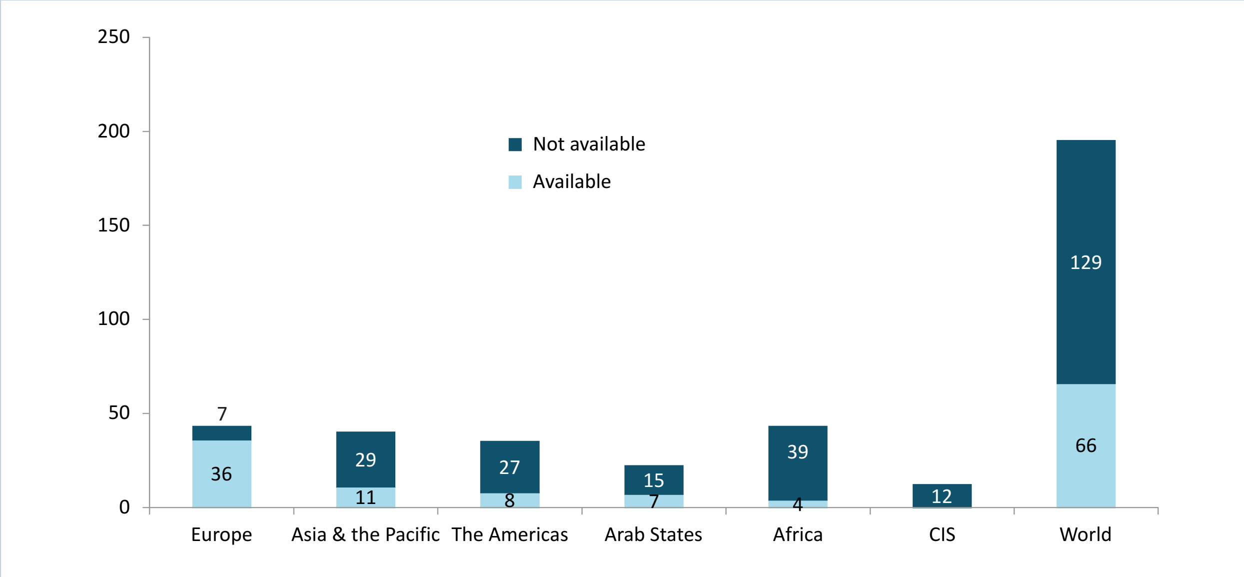
Singapore was the first country to introduce MNP in 1997, followed by Hong Kong (China), the United Kingdom and the Netherlands in 1999 (Buehler, 2005). In the European Union, MNP has been mandatory since July 2003 (European Commission, 2002). While MNP is required of all mobile operators within the EU, many countries outside Europe have not yet implemented MNP. According to ITU data, in June 2012, MNP was available to customers in 66 countries (see Chart Box 3.4).

While the implementation of MNP is usually awaited with a great deal of enthusiasm, results have not always matched the high expectations. According to ITU data, in 2009 the number of subscribers who switched operators and ported their numbers ranges from less than 1 per cent (such as in Egypt) to over 20 per cent (in the Republic of Korea) of mobile subscriptions in one year. This suggests that different factors, which vary across countries, influence the impact of MNP.

When analysing MNP, one has to look at the porting process as such, as well as the market conditions. Enhancing competition in the telecommunication sector has been the main argument for making MNP mandatory (European Union, 2009). Indeed, MNP can have a positive effect on both switching and non-switching subscribers. Switching subscribers can choose those operators and plans that are most attractive to them, without the disadvantages associated with having to change over to a new telephone number. In the process, both switching as well as non-switching customers will benefit from MNP when it boosts competition among operators, which will bring prices down and improve services. Furthermore, the shifting of mobile number property rights from provider to customer increases the intrinsic value of a number, and constitutes an investment incentive for consumers. This is especially true for business subscribers, who rely on their mobile number to stay in contact with customers and might have heavily advertised their number for that purpose (Buehler, 2005/ Haucap, 2003). However, in a market with high churn rates and where multi-SIM holding is commonplace prior to the introduction of MNP, a mobile number may be not be so highly valued, which diminishes the incentive for porting. This is true in Kenya and other countries with a high proportion of prepaid mobile customers, where customers have to ask themselves: "Why pay 200 shillings to switch when you can just buy another SIM?"[32]

How MNP is implemented has a significant impact on how well it is received. The quality, time-frames and administrative costs of MNP differ widely between countries offering the service. Within the EU, for example, communication legislation (Directive 2002/22/EC) was amended in 2009 to strengthen consumer rights by ensuring minimum delay – numbers should be activated within one working day – and prescribing cost-oriented pricing (European Commission, 2009b). In many countries, there is a fee for the service, but some operators offer MNP free of charge in an effort to attract customers. Porting might take between a couple of hours and a couple of days. The longer the delay, the less advantageous it becomes for porting subscribers. Furthermore, customers may also not be well informed about the porting process, and find it too difficult to port their numbers. In conclusion, where the costs of MNP – such as administrative costs for porting, interruption of service and complexity of the porting process – outweigh the actual benefits, then the incentive for customers to change networks diminishes.[33]

Chart Box 3.4: Total number of countries with MNP available to subscribers, world and by region, 2012



Source: ITU.

2008 and 2009 it was developed countries that recorded the greatest drop in mobile-cellular prices, this trend has been reversed since, and by 2011 mobile-cellular prices in developed countries have stabilized. It could also be argued that given the high level of mobile-cellular penetration (and saturation) in developed countries and the continuous increase in mobile data subscriptions and services, operators are venturing into new services and exploiting new revenue streams. For this reason, entry-level services, as measured by the mobile-cellular sub-basket, may no longer be the most dynamic market segment. Prices in developing countries, on the other hand, continue to fall at double-digit rates.

For the majority of economies ranked at the top of the mobile-cellular sub-basket – and for most developed economies – there has been no, or only a minor, change in the mobile-cellular sub-basket between 2010 and 2011. This is in line with the observation that by 2011 a high degree of liberalization and competition in developed economies had stabilized prices at a relatively low level.

One exception is Germany, ranked 22nd globally, which registers an increase in mobile-cellular prices. This is due to a change in market shares, with Vodafone overtaking Deutsche Telekom as the market leader in 2011. While call tariffs are the same for both operators, Vodafone charges a higher price for sms, effectively raising the mobile-cellular sub-basket value. Mobile-cellular prices substantially increased in Argentina, where Claro, the operator with the largest market share, as well as other operators, increased all mobile-cellular prices in 2011.[34] Following this increase, the mobile-cellular sub-basket value climbed from 4.3 in 2010 to 5.7 in 2011, ranking the country 107th globally, and below other countries with similar GNI per capita levels (Mexico and Lebanon, for example, which rank 61st and 86th, respectively).

Sri Lanka, a developing nation that stands out among countries with much higher GNI per capita levels, is another exception. Home to a highly proactive regulatory authority and a competitive mobile market with five operators competing for some 21 million potential customers, the country ranks 14th globally. It has some of the lowest mobile-cellular prices in the world, in USD terms as well as in relative terms (as a percentage of GNI per capita), and further cut mobile-cellular prices by over 40 per cent between 2010 and 2011, mainly through a reduction in on-net call prices.

In general, the largest price reductions over the 2010 to 2011 period are found in developing economies, where

prices remain relatively high. A developing economy that has achieved noteworthy price reductions between 2010 and 2011 is Kenya (ranked 114th), where the mobile-cellular sub-basket value fell by 62 per cent, from 17.8 to 6.8, within a year. The country's mobile market, which is run by four mobile operators, reacted to lower mobile termination rates introduced by the Communications Commission of Kenya and steep price cuts introduced in early 2011 by Airtel, the second largest operator in terms of market share (close to 10 per cent by end 2010), in an obvious bid to increase its market share.[35] Major price reductions between 2010 and 2011 also occurred in Tanzania, Comoros, Burkina Faso and Niger. All four countries, however, still have relatively high mobile-cellular prices, with a mobile-cellular sub-basket value of above 20 per cent in 2011. In other words, while in relative terms prices have come down a lot, they remain relatively unaffordable. Not surprisingly, mobile-cellular penetration rates in those four countries remain below or (in the case of Tanzania) just above the 50 per cent mark, well short of the developing country average of 79 per cent in 2011.

In Turkey, where the mobile-cellular sub-basket has dropped from 5.3 to 4.1, ranking the country 97th globally in 2011, customers have benefited from a high degree of competition, reinforced through mobile number portability since 2008[36] and the lowering of mobile-interconnection rates by the regulatory authority (ICTA) in mid-2010. Despite active price competition between the three established mobile network operators, Turkcell continues to dominate the market with over 50 per cent of the number of subscriptions. The further strengthening of competition, for example through the introduction of MVNOs, which has been under discussion for several years, could further bring down prices and increase mobile penetration, which has been stagnating at around 90 per cent since 2007.[37]

Fixed-broadband sub-basket

In 2011, the differences in price and affordability of an entry-level fixed-broadband connection among the 161 countries for which prices were available are considerable, and the fixed-broadband sub-basket ranges from 0.3 per cent of GNI per capita in Macao (China) to 747.4 per cent in Gambia. In about half of all countries (84 out of 161), the monthly price of an entry-level fixed-broadband subscription (based on 1 GB of download volume) represents 5 per cent or less of average monthly GNI per capita. In around one-quarter of all countries included in the IPB, it represents more than 20 per cent, and in 17 countries the price actually exceeds the average income (Table 3.4).

There is a strong correlation between GNI per capita levels and the affordability of fixed-broadband services. A regression analysis comparing GNI per capita levels to the fixed-broadband sub-basket value indicates an R-squared value of 0.77.[38] The countries with the most affordable fixed-broadband sub-basket are all high-income economies, including Macao (China), United States, Switzerland, United Kingdom and Japan. As in the case of the mobile-cellular sub-basket, the list of countries with the relatively most expensive fixed-broadband services is dominated by low-income developing countries, including Gambia, Eritrea, Tajikistan, Togo, Rwanda and Niger. Eighteen out of 25 countries at the bottom of the fixed-broadband sub-basket are LDCs.

As highlighted in section 3.2, the fixed-broadband sub-basket has displayed the strongest price fall over the last years, in particular in developing countries, where prices continue to fall by over 30 per cent annually. In developed countries, on the other hand, prices dropped by about half the rate in developing countries between 2008 and 2010. Between 2010 and 2011, the fixed-broadband sub-basket actually increased in developed countries, albeit only slightly. While this implies that prices are increasing, or at least no longer decreasing, a key explanation is that entry-level fixed-broadband prices in most developed countries have reached relatively low levels and in many cases operators are raising speeds and/or data volume caps – which determine the amount of data that users can download every month – instead of further reducing prices. This suggests that customers often get more or, rather, faster services for the money that they are paying.

In most of the 30 countries with the lowest fixed-broadband sub-basket, relative prices did not change, or changed very little, between 2010 and 2011. Exceptions include the United Kingdom, where continued competitive pressure, including Ofcom's decision to cut the amount that British Telecom (BT) can charge other providers for access to its network, has pushed retail broadband prices down and led to a decrease of 19 per cent in the fixed-broadband sub-basket.[39]

Based on the entry-level plan with 1 GB of download volume, almost all other price increases come with either a rise in the data volume cap or an increase in speed. In several cases, both were raised. Examples of countries where the fixed-broadband price increase between 2010 and 2011 is accompanied by an increase in speed include Bhutan, Hong Kong (China), Iceland, Mexico, Serbia and Micronesia. Iceland's 8 per cent increase in the fixed-broadband sub-basket value provides users with (theoretical) speeds of 12 Mbit/s in 2011, as compared with 2 Mbit/s in 2010. In Hong Kong (China), an 11.5 per cent rise in the price comes with a speed increase from 8 Mbit/s to no less than 200 Mbit/s. In Bhutan and Micronesia, speeds doubled, while Telmex's Infinium (unlimited) broadband plan in Mexico has raised advertised download speeds from 1 Mbit/s to 6 Mbit/s.

Countries where a higher sub-basket value reflects both an improved data volume cap and higher speeds include Albania, Australia, Nigeria and Sri Lanka. In Nigeria, the 13 per cent price increase has made a substantial difference in the service provided, which in 2011 was unlimited access at advertised speeds of 8 Mbit/s, as against 0.8 Mbit/s and a limit of 5 GB a year before. Many of the countries that have raised the data volume cap, have also witnessed a sharp increase in international Internet bandwidth. Tonga, where a 15 per cent increase in price allows users to download 3 GB instead of 1 GB of data, doubled its bandwidth between 2010 and 2011. International Internet bandwidth also doubled in Sri Lanka over the same period.

A number of (mainly developing) countries have cut the price of an entry-level broadband service substantially between 2010 and 2011. In some cases, for example Chile, lower prices are accompanied by the curtailment of previously unlimited data allowances. Although the price of the fixed-broadband connection in Chile declined by 50 per cent, the 2011 plan is limited to 3 GB of data, instead of the unlimited allowance under the 2010 plan. Most broadband price reductions, however, are real and sometimes even come with improved data caps or faster speeds.

Increased availability of international Internet bandwidth, but also an expansion of the national backbone infrastructure, are key factors that can drive down prices (and raise data caps and speeds) for broadband access, particularly in countries where these infrastructures have been the main bottleneck. Many consumers in countries where broadband services used to be provided through only one operator and one technology are also benefiting from stronger competition, not only from alternative DSL and cable operators but also from mobile-broadband operators.

In some countries, regulators and governments are directly intervening in wholesale and retail broadband pricing regulation. Lebanon's drop in fixed-broadband prices, for example, resulted from an increase in international Internet bandwidth along with a government decree which mandated ISPs to lower their prices and provide higher data speeds.[40]

In Cape Verde, prices for fixed broadband went down by 63 per cent, while both the data cap and the speed went up. Over the same time period, the country doubled the amount of international Internet bandwidth, and increased the number of fixed-broadband subscriptions by almost 40 per cent. The country's largest telecommunication operator, Cabo Verde Telecom, has made major investments to upgrade the telecommunication infrastructure and the broadband network, which has been expanded to all regions of the country, while at the same time following a "broadband price reduction strategy" to encourage new customers to take up the service.[41] Guyana's fixed-broadband sub-basket fell by almost 50 per cent between 2010 and 2011, also thanks to the increase in Internet bandwidth that came with the new Suriname-Guyana submarine cable system at the end of 2010.[42]

Most of the significant price reductions for fixed-broadband services between 2010 and 2011 occurred in countries with relatively high fixed-broadband prices. The highest percentage reductions – of over 90 per cent – were registered in Zimbabwe and Ethiopia. Comoros and Madagascar, two countries where international Internet bandwidth has been substantially increased between 2009 and 2011, brought their fixed-broadband sub-basket values down by 79 and 58 per cent, respectively. While these are very positive developments, fixed-broadband prices in these countries remain largely unaffordable, given that the sub-basket still corresponds to over 75 per cent of average GNI per capita levels. Finally, a number of low-income developing countries with very high fixed-broadband prices have not been able to reduce prices at all between 2010 and

Table 3.4: Fixed-broadband sub-basket, 2011 and 2010

Rank	Economy	Fixed-broadband sub-basket as % of GNI per capita		Value change	Relative change (%)	Fixed-broadband sub-basket, USD	Fixed-broadband sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
		2011	2010	2010-2011				
1	Macao, China	0.3	0.3	0.0	-6	8.5	10.5	34'880
2	Israel	0.4	0.4	0.0	9	8.8	8.7	27'170
3	United States	0.5	0.5	0.0	0	20.0	20.0	47'390
4	Switzerland	0.5	0.5	0.0	0	32.7	22.5	71'530
5	Luxembourg	0.6	0.6	0.0	0	38.1	31.7	77'160
6	United Kingdom	0.6	0.8	-0.1	-19	20.0	20.0	38'370
7	Belgium	0.7	0.6	0.0	1	25.2	22.1	45'910
8	Japan	0.7	0.7	0.0	5	24.2	19.0	41'850
9	Norway	0.7	0.7	0.0	0	49.1	33.2	84'290
10	Hong Kong, China	0.8	0.7	0.1	11	21.2	31.1	32'780
11	Singapore	0.8	0.8	0.0	-2	26.2	34.2	40'070
12	Sweden	0.8	0.8	0.0	-4	33.1	26.4	50'110
13	Netherlands	0.8	0.8	0.0	0	32.9	29.8	49'050
14	Canada	0.8	0.7	0.1	13	29.5	24.9	43'270
15	Cyprus	0.8	1.4	-0.6	-40	20.7	22.6	29'430
16	Greece	0.9	0.8	0.0	2	19.2	20.2	26'940
17	Finland	0.9	0.9	0.0	0	35.4	29.3	47'720
18	Denmark	0.9	0.9	0.0	0	43.9	31.3	59'050
19	France	0.9	0.9	0.0	5	31.6	27.2	42'390
20	Italy	0.9	0.9	0.0	1	26.5	24.8	35'150
21	Qatar	0.9	0.9	0.0	0	54.9	72.3	71'008
22	Ireland	1.0	1.0	0.0	0	32.9	28.9	41'000
23	Trinidad & Tobago	1.0	1.0	0.0	0	12.5	21.0	15'380
24	Iceland	1.0	0.9	0.1	8	26.8	23.7	32'710
25	Austria	1.0	1.0	0.0	0	39.3	35.0	47'060
26	Lithuania	1.1	1.1	0.0	0	10.3	17.2	11'390
27	Germany	1.1	1.1	0.0	0	39.4	36.8	43'110
28	Malta	1.1	1.1	0.0	0	18.2	24.5	19'270
29	United Arab Emirates	1.2	1.2	0.0	0	40.6	48.3	41'930
30	Spain	1.2	1.2	0.0	0	30.9	32.7	31'750
31	Russian Federation	1.2	1.2	0.0	0	9.9	18.7	9'900
32	Bahrain	1.3	1.3	0.0	0	26.6	33.3	25'420
33	Latvia	1.3	1.3	0.0	1	12.9	20.0	11'620
34	Romania	1.4	1.4	0.0	0	9.1	17.3	7'840
35	Portugal	1.5	1.4	0.1	5	27.6	33.1	21'880
36	Australia	1.5	1.0	0.5	50	55.3	39.6	43'590
37	Korea (Rep.)	1.6	1.6	0.0	0	25.7	36.3	19'890
38	Croatia	1.6	1.6	0.0	0	18.2	25.8	13'870
39	Venezuela	1.6	1.5	0.1	10	15.7	23.0	11'590
40	Turkey	1.7	2.3	-0.7	-28	13.8	21.1	9'890
41	New Zealand	1.7	1.5	0.2	12	40.5	37.2	28'770
42	Oman	1.7	2.2	-0.5	-23	25.9	40.3	18'260
43	Slovenia	1.7	1.7	0.0	0	34.2	40.8	23'860
44	Bahamas	1.7	2.0	-0.3	-14	30.0	34.6	20'610
45	Estonia	1.7	1.7	0.0	0	21.1	N/A	14'460
46	Brunei Darussalam	1.8	1.9	-0.1	-4	48.3	81.5	31'800
47	Slovakia	1.9	1.8	0.0	1	26.1	38.4	16'830
48	Poland	1.9	1.7	0.1	7	19.4	31.5	12'440
49	Maldives	1.9	1.9	0.0	0	9.3	13.2	5'750
50	Saudi Arabia	2.0	2.0	0.0	0	26.6	38.2	16'190
51	Bosnia and Herzegovina	2.0	3.4	-1.4	-41	7.9	15.4	4'770
52	Hungary	2.0	1.9	0.1	5	21.7	34.1	12'850
53	Mauritius	2.0	2.5	-0.5	-20	13.1	23.3	7'750
54	Czech Republic	2.1	2.1	0.0	0	31.2	43.5	17'890
55	Brazil	2.2	4.0	-1.8	-46	16.9	17.7	9'390
56	Uruguay	2.2	2.2	0.0	0	19.3	23.3	10'590
57	Chile	2.3	4.7	-2.3	-50	19.7	24.8	10'120
58	Lebanon	2.4	3.4	-1.0	-30	17.6	26.7	8'880
59	Mexico	2.5	2.3	0.1	5	18.2	28.9	8'890
60	Costa Rica	2.5	2.6	-0.1	-5	13.9	20.7	6'810
61	Panama	2.5	2.9	-0.3	-12	14.7	26.8	6'970
62	Bulgaria	2.6	2.6	0.0	0	13.4	29.5	6'270
63	Azerbaijan	2.8	2.8	0.0	0	12.5	21.6	5'330
64	Sri Lanka	2.9	2.7	0.2	9	5.5	11.6	2'240
65	Tunisia	3.0	3.0	0.0	0	10.5	23.8	4'160
66	Ukraine	3.0	3.0	0.0	0	7.6	16.9	3'000
67	Malaysia	3.2	3.2	0.0	0	20.5	36.0	7'760
68	Montenegro	3.3	3.3	0.0	0	18.4	37.0	6'750
69	TFYR Macedonia	3.4	3.4	0.0	0	12.8	32.2	4'570
70	Argentina	3.4	3.6	-0.2	-5	24.3	42.6	8'620
71	Albania	3.5	3.3	0.3	9	11.7	27.6	3'960
72	Belarus	3.6	3.6	0.0	0	18.1	43.8	5'950
73	St. Kitts and Nevis	3.7	3.7	0.0	0	36.7	49.1	11'740
74	Barbados	3.8	3.7	0.1	2	39.6	59.5	12'660
75	Georgia	3.8	3.8	0.0	0	8.4	16.3	2'690
76	Kazakhstan	3.8	2.1	1.7	81	23.9	31.9	7'590
77	Egypt	4.0	4.0	0.0	0	8.0	18.7	2'420
78	Serbia	4.2	3.3	1.0	30	19.8	42.2	5'630
79	Cape Verde	4.3	11.6	-7.2	-63	11.8	14.2	3'270
80	Dominican Rep.	4.5	4.5	0.0	-1	18.9	33.9	5'030
81	Algeria	4.8	4.0	0.8	21	17.8	33.3	4'450

Table 3.4: Fixed-broadband sub-basket, 2011 and 2010 (continued)

Rank	Economy	Fixed-broadband sub-basket as % of GNI per capita 2011	Fixed-broadband sub-basket as % of GNI per capita 2010	Value change 2010-2011	Relative change (%) 2010-2011	Fixed-broadband sub-basket, USD	Fixed-broadband sub-basket, PPP$	GNI per capita, USD, 2010 (or latest available)
82	Morocco	4.9	4.9	0.0	0	11.7	19.8	2'850
83	Antigua & Barbuda	5.0	5.2	-0.2	-3	54.9	83.6	13'170
84	China	5.0	5.0	0.0	0	17.8	30.4	4'270
85	Grenada	5.1	5.1	0.0	0	29.4	41.8	6'930
86	Seychelles	5.1	5.9	-0.8	-13	41.8	88.1	9'760
87	Colombia	5.2	7.7	-2.5	-33	23.7	36.0	5'510
88	Botswana	5.2	5.2	0.0	0	29.7	55.0	6'790
89	Saint Lucia	5.4	5.4	0.0	0	29.3	46.1	6'560
90	South Africa	5.4	5.4	0.0	0	27.4	39.5	6'090
91	India	5.5	5.5	0.0	0	6.1	14.9	1'330
92	El Salvador	5.6	8.8	-3.2	-36	15.8	30.8	3'380
93	Thailand	5.8	5.5	0.4	7	20.2	37.5	4'150
94	Dominica	5.9	8.5	-2.6	-31	33.0	58.9	6'760
95	Fiji	6.2	6.1	0.1	2	18.7	23.5	3'630
96	Jordan	6.2	8.3	-2.1	-25	22.6	28.6	4'340
97	St. Vincent and the G.	6.4	6.4	0.0	0	33.6	57.6	6'300
98	Bhutan	7.0	6.7	0.3	4	10.9	27.8	1'870
99	Ecuador	7.0	7.0	0.0	0	22.6	45.2	3'850
100	Jamaica	7.3	7.3	0.0	0	29.0	42.7	4'800
101	Peru	7.6	10.8	-3.2	-30	29.6	52.1	4'700
102	Armenia	7.9	12.1	-4.2	-35	21.0	37.6	3'200
103	Moldova	8.1	8.1	0.0	0	12.2	23.1	1'810
104	Paraguay	8.5	8.4	0.1	1	19.2	35.1	2'710
105	Suriname	8.5	8.5	0.0	0	42.1	53.2	5'920
106	Syria	9.4	9.4	0.0	0	21.6	39.1	2'750
107	Indonesia	10.4	10.4	0.0	0	21.6	31.5	2'500
108	Guyana	10.4	19.6	-9.2	-47	24.9	28.6	2'870
109	Viet Nam	10.8	10.8	0.0	0	10.5	28.1	1'160
110	Guatemala	12.0	14.2	-2.3	-16	27.3	45.6	2'740
111	Honduras	12.2	14.1	-1.9	-14	19.0	36.8	1'870
112	Philippines	12.9	12.9	0.0	0	22.1	41.1	2'060
113	Bangladesh	14.3	14.3	0.0	0	8.3	20.4	700
114	Belize	15.6	31.5	-15.9	-50	49.7	82.1	3'810
115	Pakistan	16.2	16.2	0.0	0	14.2	37.7	1'050
116	Angola	16.5	40.6	-24.1	-59	54.3	74.6	3'940
117	Bolivia	16.9	23.2	-6.2	-27	25.5	62.5	1'810
118	Yemen	18.7	18.7	0.0	0	16.7	40.2	1'070
119	Nicaragua	21.1	37.2	-16.1	-43	19.6	50.7	1'110
120	Micronesia	22.0	17.6	4.4	25	50.0	62.2	2'730
121	Tonga	22.8	19.8	3.0	15	62.3	79.9	3'280
122	Samoa	24.3	24.3	0.0	0	60.8	81.1	3'000
123	Sudan	27.4	N/A	N/A	N/A	29.0	49.6	1'270
124	Mauritania	27.4	27.4	0.0	0	23.5	43.9	1'030
125	Ghana	30.8	30.8	0.0	0	31.5	40.1	1'230
126	Namibia	31.6	31.6	0.0	0	118.7	142.9	4'500
127	Uganda	39.0	39.0	0.0	0	16.3	43.5	500
128	Djibouti	39.5	56.4	-16.9	-30	41.8	80.9	1'270
129	Senegal	39.7	39.7	0.0	0	36.1	67.9	1'090
130	Côte d'Ivoire	41.5	41.5	0.0	0	40.1	66.4	1'160
131	Cambodia	48.0	72.0	-24.0	-33	30.0	82.4	750
132	Timor-Leste	53.5	53.5	0.0	0	99.0	147.3	2'220
133	Kenya	57.4	57.6	-0.2	0	37.8	80.2	790
134	Cameroon	59.1	81.5	-22.4	-28	58.1	116.9	1'180
135	Nigeria	60.7	54.0	6.7	13	59.7	116.6	1'180
136	Lesotho	61.2	58.8	2.4	4	53.0	82.7	1'040
137	Nepal	63.4	63.4	0.0	0	23.3	51.9	440
138	Zambia	65.0	65.0	0.0	0	58.0	71.7	1'070
139	Tanzania	70.8	70.8	0.0	0	31.3	86.8	530
140	Benin	77.1	77.1	0.0	0	50.1	106.9	780
141	Vanuatu	77.7	77.7	0.0	0	171.0	254.8	2'640
142	Zimbabwe	78.3	1059.0	-980.7	-93	30.0	N/A	460
143	Ethiopia	85.0	906.0	-821.0	-91	27.6	90.1	390
144	Mali	94.6	100.2	-5.6	-6	47.3	84.3	600
145	Madagascar	106.9	253.0	-146.1	-58	38.3	87.0	430
146	Iraq	108.3	N/A	N/A	N/A	211.3	296.7	2'340
147	Lao P.D.R.	111.0	159.6	-48.6	-30	97.2	211.8	1'050
148	Burkina Faso	113.5	180.1	-66.6	-37	52.0	122.9	550
149	Comoros	128.3	620.0	-491.7	-79	80.2	120.3	750
150	Mozambique	135.5	135.5	0.0	0	49.7	115.1	440
151	Uzbekistan	187.5	187.5	0.0	0	200.0	452.8	1'280
152	Niger	193.4	193.4	0.0	0	59.6	122.2	370
153	S. Tomé & Principe	221.3	285.4	-64.1	-22	221.3	349.2	1'200
154	Kiribati	228.7	228.7	0.0	0	383.1	618.9	2'010
155	Rwanda	257.8	377.4	-119.6	-32	111.7	244.4	520
156	Cuba	379.0	379.0	0.0	0	1752.7	N/A	5'550
157	Swaziland	399.1	399.1	0.0	0	874.6	1430.7	2'630
158	Togo	405.5	405.5	0.0	0	165.6	318.2	490
159	Tajikistan	543.7	543.7	0.0	0	362.5	963.5	800
160	Eritrea	720.0	N/A	N/A	N/A	204.0	269.6	340
161	Gambia	747.4	N/A	N/A	N/A	280.3	899.8	450

Source: ITU. GNI per capita and PPP$ values are based on World Bank data.
Note: N/A: Not available.

2011. These include Tajikistan, Togo, Swaziland, Cuba, Niger and Uzbekistan. Unless more efforts are undertaken to make broadband affordable, these countries run the risk of being excluded from the global information society.

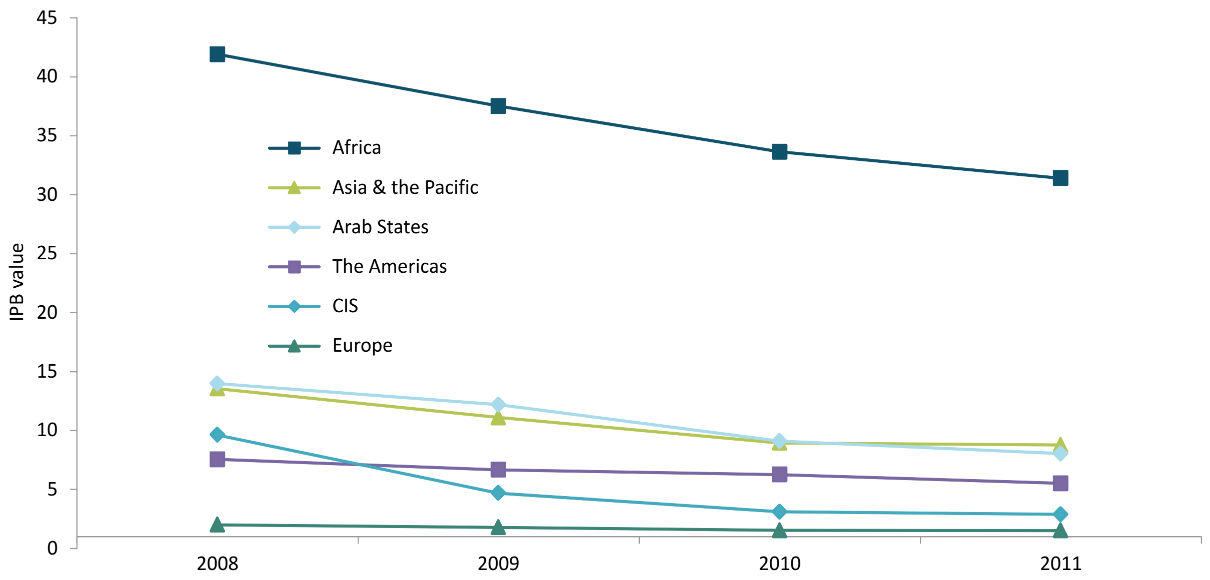
In almost all developed and developing countries where the fixed-broadband sub-basket value has increased, the higher price comes with better service. Countries where customers pay more for the same service remain the exception. One such instance is Canada, where Bell increased the price for its entry-level broadband service in 2011 (and again in early 2012), with customers paying about CAD 3 more for the same service (speed and cap) per month. Despite this price increase, the country still offers relatively affordable broadband services, and is ranked 14th globally.[43] Another example is Kazakhstan, where between 2010 and 2011 the fixed-broadband sub-basket went up from 2.1 to 3.8, mainly due to a change in the plan used for the sub-basket. Kazakh Telecom JSC, the country's leading telecommunication operator, altered the data cap for its entry-level broadband service from an unlimited offer in 2010 to a cap of 0.8 GB a month. Once customers exceed this allowance, speeds are throttled down to narrowband speed, which means the plan cannot be used to measure the fixed-broadband sub-basket (which is based on a 1 GB cap). The next available broadband offer is almost twice as expensive, but also includes a 10 GB data allowance and higher speeds (1 Mbit/s instead of 256 kbit/s in the unlimited 2010 plan).

3.4 Regional analysis of the ICT Price Basket and sub-baskets[44]

Overview

A regional comparison of the IPB between 2008 and 2011 shows that while over this four-year period the price of ICT services fell in all regions of the world, services remain much more affordable in some regions than in others.[45] In particular, prices in Africa remain high, with a 2011 IPB value of 31.4, as compared with 8.8, 8.0 and 5.5 in Asia and the Pacific, the Arab States and the Americas, respectively. In the Commonwealth of Independent States (CIS) and Europe, the IPB value in 2011 had reached 2.9 and 1.5, respectively, making them the regions with the most affordable ICT services in the world (Chart 3.8).

Chart 3.8: ICT Price Basket by region, 2008-2011



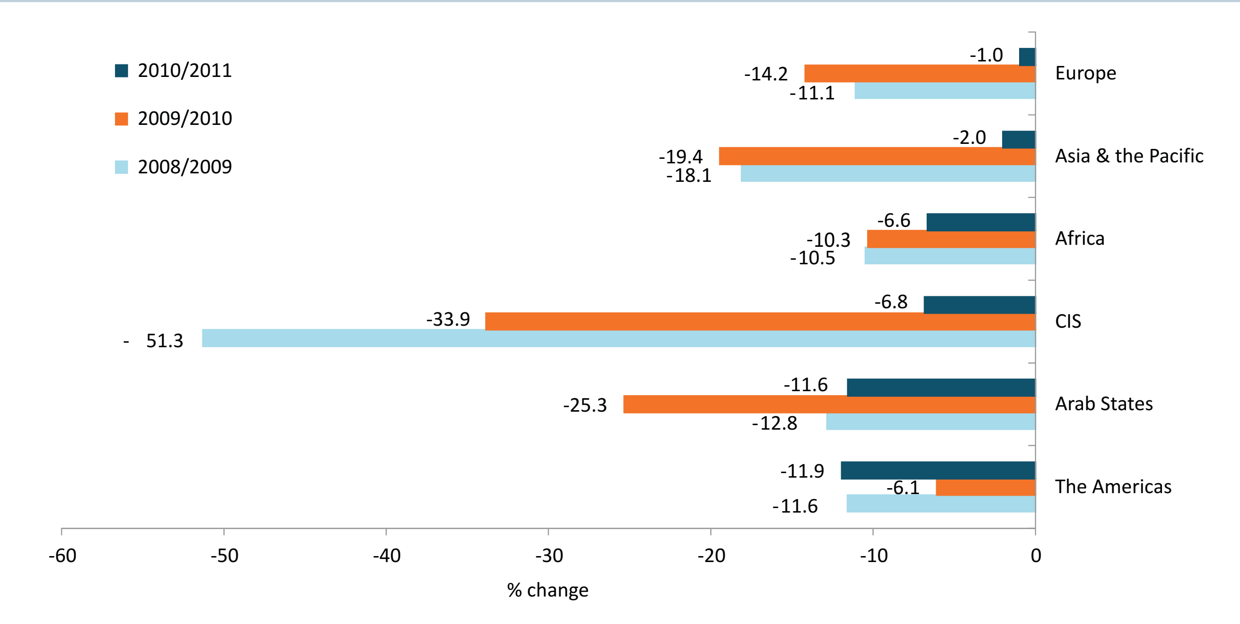
Source: ITU.
Note: Simple averages. The regional averages in this chart are based on prices for the 144 countries for which prices are available for 2008, 2009, 2010 and 2011.

While in every year since 2008 ICT services have become more affordable across all regions, the largest decrease occurred between 2008 and 2009, when all regions showed double-digit price drops (Chart 3.9). In that year, the largest IPB value drop of over 50 per cent was registered in the CIS, followed by Asia and the Pacific (18.1 per cent) and the Arab States (12.8 per cent). Between 2009 and 2010, prices continued to fall substantially and the IPB value decreased by 33.9 and 25.3 per cent in the CIS and the Arab States, respectively. Only the Americas showed a relatively moderate price decrease well below 10 per cent. More recently, between 2010 and 2011, prices in all regions have declined at a much slower rate. However, the Americas is the only region where prices fell more between 2010 and 2011 than the year before, and the region actually witnessed the highest IPB value drop of 11.9 per cent, just ahead of the Arab States (11.6 per cent). IPB values in all other regions fell by a single digit only, and decreases were most moderate in Europe (1 per cent) and Asia and the Pacific (2 per cent). While Europe's slowdown can be explained by relatively low IPB values (and affordable ICT services), prices in Asia and the Pacific remain relatively high, suggesting that more must be done there to stimulate price cuts. The same is true for Africa – the region with the most expensive ICT prices – where price drops have been generally more moderate than in other regions.[46]

Over the same four-year period, prices for all sub-baskets also fell in all regions of the world (Chart 3.10). Africa's fixed-broadband sub-basket has become much more affordable over this period, going from 458.1 in 2008 to 95.9 in 2011. Prices in Africa also fell steeply for mobile-cellular services, with the mobile-cellular sub-basket decreasing from 32.4 to 19.6. The fixed-telephone sub-basket decreased from 20.5 to 15.6. Nevertheless, compared with other regions, all of Africa's ICT prices remain relatively expensive. In contrast, all of Europe's sub-baskets have been relatively affordable since 2008, not exceeding 3 per cent of GNI per capita. By 2011, the fixed-telephone, mobile-cellular and fixed-broadband sub-basket values stood at 1.2, 1.8 and 1.5 per cent of GNI per capita, respectively.

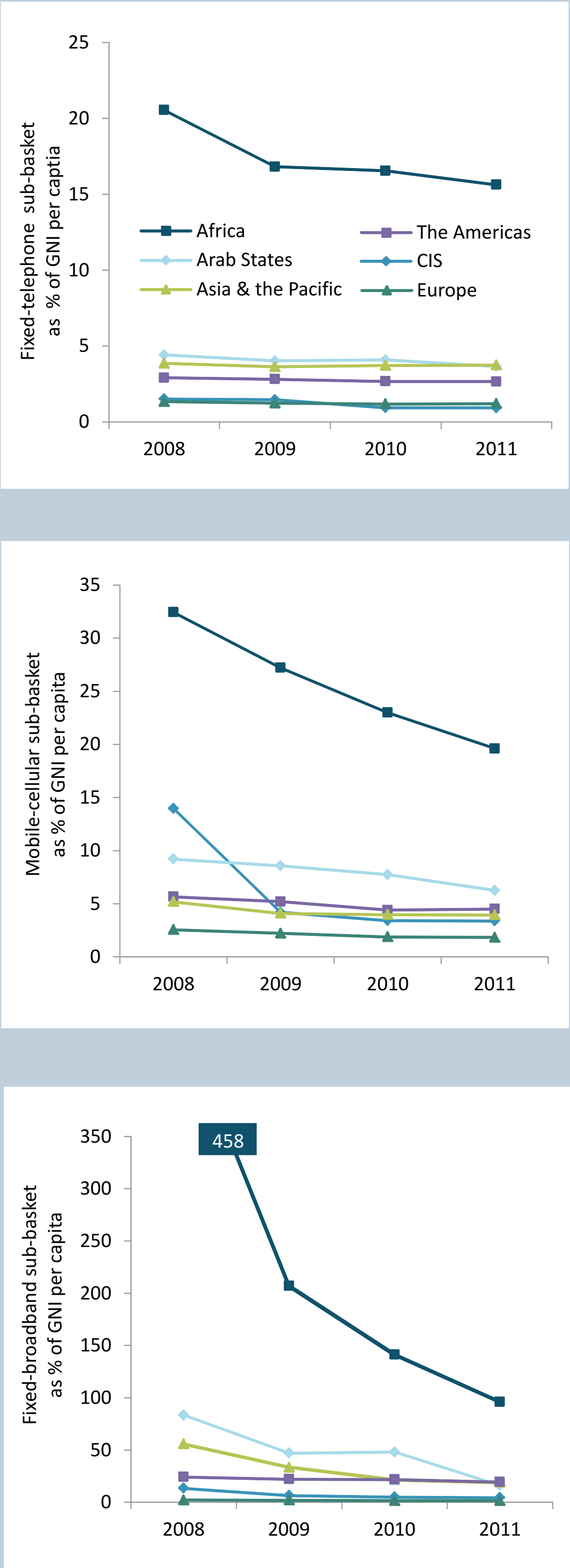
The Arab States have witnessed a significant drop in the price for mobile cellular, but most of all for fixed-broadband services: the fixed-broadband sub-basket was slashed from 83.4 per cent in 2008 to 15.9 per cent in 2011. In the CIS,

Chart 3.9: ICT Price Basket annual change (%), by region



Source: ITU.
Note: Simple averages. The regional averages in this chart are based on prices for the 144 economies for which IPB values are available for 2008, 2009, 2010 and 2011.

Chart 3.10: IPB sub-baskets by region, 2008-2011



Source: ITU.
Note: Simple averages.

both the mobile-cellular and the fixed-broadband sub-baskets came down from similar levels in 2008 (13.9 and 13.4, respectively) to below 5 per cent by 2011. In 2008, both the Americas and Asia and the Pacific already enjoyed relatively affordable mobile-cellular prices (with mobile-cellular sub-baskets of 5.6 and 5.1, respectively) and both regions further reduced these values, to 4.5 and 3.9 per cent, respectively, by 2011. By 2011, these two regions also registered very similar fixed-broadband sub-baskets (at just over 19), although Asia and the Pacific started off with much higher relative prices in 2008 (55.6, as against 24.1 in the Americas).

Except in Africa, the price of fixed-telephone services has been affordable since 2008 (not exceeding 5 per cent of GNI per capita in any other region). By 2011, all regions had a fixed-telephone sub-basket below 3.7 per cent, as compared with 16 per cent in Africa.

It should be noted that the regional IPB values are based on simple averages and that there are significant differences between countries within each region. These differences are highlighted in the following sections, which will look at ICT prices in the six regions in turn.[47] Prices will be viewed in terms of the affordability of the service (and hence measured as a percentage of GNI per capita). At the same time, the regional analyses will highlight country-specific developments by comparing purchasing power parity (PPP) prices, which take into account the local buying power of a national currency and highlight the cost of ICT services in comparison with other services and products within a country.[48] Given the relatively low level of the fixed-telephone sub-basket in 2011 for all regions (except for Africa) and the relatively small changes between 2008 and 2011, this section will focus on the mobile-cellular and fixed-broadband sub-baskets, which show greater movement (between 2008 and 2011) and greater disparities in 2011.

The ICT Price Basket in Africa

Africa, with a regional 2011 IPB value of 31.4, is the region where ICT services are least affordable. The large majority of countries in the region are classified as LDCs, with very low GNI per capita levels. Considering the strong link between development/income levels and the affordability of ICT services, it is not surprising that, with the exception of Zimbabwe, the lowest ranked countries on the IPB scale

are African LDCs. Madagascar, with an IPB value of 64.6, ranks lowest.

Within the Africa region, ICT services are most affordable in the countries with the highest GNI per capita levels. Mauritius, which ranks 39th globally, tops the African list, followed by Seychelles, Botswana and South Africa. These four countries are the only countries where the IPB represents less than 5 per cent of average monthly GNI per capita. In Cape Verde and Angola, another two countries that have relatively high GNI per capita compared with others in the region, the 2011 IPB has been brought down to relatively low levels, below 10 per cent, and in both Namibia and Ghana it represents less than 15 per cent of GNI per capita.

In the remaining 23 African countries covered in the 2011 IPB, ICT services cost more than 20 per cent of GNI per capita, suggesting that they are thus unaffordable for large parts of the population. The fixed-broadband sub-basket in Africa is by far the most expensive. In ten out of 31 countries, including Swaziland, Eritrea, Togo and Rwanda, the IPB actually exceeds average monthly GNI per capita, and in the majority of countries monthly fixed-broadband services cost over 50 per cent of GNI per capita (Table 3.5).

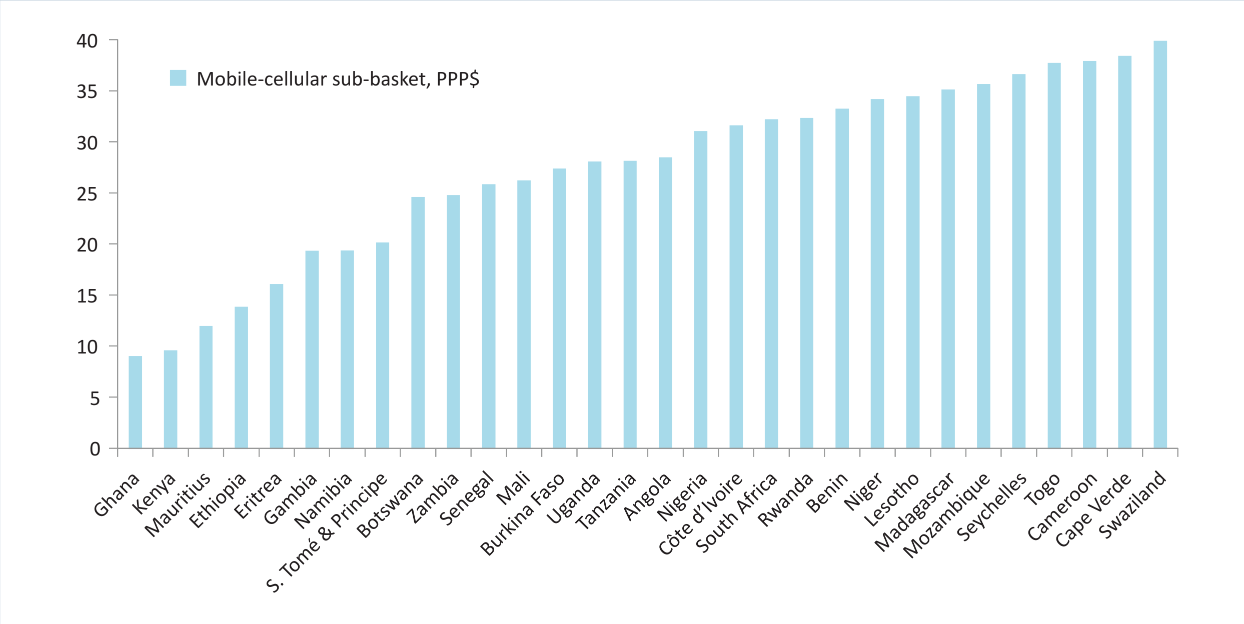
When looking at mobile-cellular and fixed-broadband prices in terms of PPP$ (Chart 3.11), which expresses the price of goods in terms of buying power and adjusts exchange rates to facilitate international comparisons, a number of important observations can be made. Ghana, for example, ranks high in both sub-baskets compared to other lower-middle-income economies[49] and even countries with a higher GNI per capita level. The country has the cheapest mobile-cellular sub-basket and ranks in the top five of the fixed-broadband sub-basket in terms of PPP$. Ghana has a competitive mobile market, with five mobile operators, and a 2011 mobile-cellular penetration of 85 per cent.[50] Intense competition has prompted operators to further lower prices ahead of the introduction of mobile number portability (MNP) in July 2011 and the

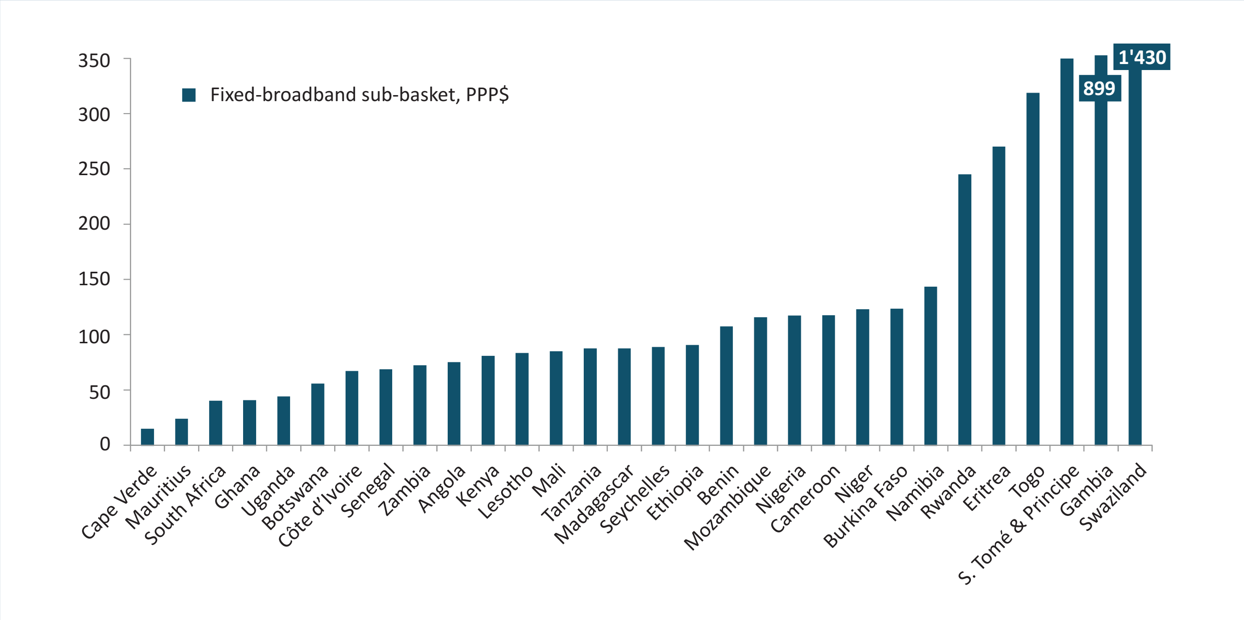
Table 3.5: IPB and sub-baskets (USD, PPP$ and as a percentage of GNI per capita), 2011, Africa

Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Average annual GNI per capita, USD, 2010
				USD			PPP$			% of GNI per capita			
39	1	Mauritius	1.3	5.1	6.7	13.1	9.2	11.9	23.3	0.8	1.0	2.0	7'750
72	2	Seychelles	2.8	9.4	17.4	41.8	19.8	36.5	88.1	1.2	2.1	5.1	9'760
81	3	Botswana	3.5	17.2	13.2	29.7	31.9	24.5	55.0	3.0	2.3	5.2	6'790
98	4	South Africa	4.8	23.2	22.3	27.4	33.4	32.1	39.5	4.6	4.4	5.4	6'090
108	5	Cape Verde	6.3	8.3	31.7	11.8	10.1	38.3	14.2	3.1	11.6	4.3	3'270
115	6	Angola	9.4	17.3	20.7	54.3	23.8	28.4	74.6	5.3	6.3	16.5	3'940
122	7	Namibia	13.2	14.1	16.0	118.7	17.0	19.3	142.9	3.8	4.3	31.6	4'500
124	8	Ghana	14.3	5.5	7.0	31.5	7.0	8.9	40.1	5.4	6.9	30.8	1'230
128	9	Senegal	22.0	10.3	13.7	36.1	19.3	25.8	67.9	11.3	15.1	39.7	1'090
131	10	Côte d'Ivoire	27.1	19.6	19.0	40.1	32.5	31.5	66.4	20.3	19.7	41.5	1'160
133	11	Kenya	28.6	14.2	4.5	37.8	30.0	9.5	80.2	21.5	6.8	57.4	790
134	12	Uganda	29.9	10.7	10.5	16.3	28.6	28.0	43.5	25.7	25.1	39.0	500
135	13	Nigeria	31.1	16.1	15.9	59.7	31.5	31.0	116.6	16.4	16.1	60.7	1'180
136	14	Zambia	32.0	7.5	20.0	58.0	9.3	24.7	71.7	8.4	22.4	65.0	1'070
137	15	Cameroon	32.2	17.9	18.8	58.1	36.1	37.8	116.9	18.2	19.1	59.1	1'180
138	16	Ethiopia	33.8	1.1	4.2	27.6	3.6	13.8	90.1	3.4	13.0	85.0	390
139	17	Lesotho	33.9	13.0	22.0	53.0	20.3	34.4	82.7	15.0	25.4	61.2	1'040
145	18	Swaziland	37.8	5.0	24.3	874.6	8.2	39.8	1430.7	2.3	11.1	399.1	2'630
147	19	Benin	38.3	9.0	15.5	50.1	19.2	33.2	106.9	13.9	23.9	77.1	780
149	20	Tanzania	39.7	11.2	10.1	31.3	31.2	28.1	86.8	25.5	22.9	70.8	530
150	21	S. Tomé & Principe	40.3	8.3	12.7	221.3	13.1	20.1	349.2	8.3	12.7	221.3	1'200
151	22	Gambia	41.8	3.5	6.0	280.3	11.2	19.3	899.8	9.3	16.0	747.4	450
153	23	Mali	46.6	7.9	14.7	47.3	14.0	26.1	84.3	15.7	29.3	94.6	600
154	24	Rwanda	51.6	9.0	14.7	111.7	19.7	32.3	244.4	20.8	34.0	257.8	520
155	25	Eritrea	51.8	3.6	12.1	204.0	4.7	16.0	269.6	12.7	42.8	720.0	340
156	26	Burkina Faso	51.8	13.9	11.6	52.0	32.8	27.3	122.9	30.3	25.2	113.5	550
157	27	Zimbabwe	52.8	10.1	20.6	30.0	N/A	N/A	N/A	26.3	53.7	78.3	460
158	28	Mozambique	57.8	11.5	15.4	49.7	26.7	35.6	115.1	31.4	41.9	135.5	440
159	29	Togo	60.5	13.7	19.6	165.6	26.2	37.6	318.2	33.5	48.0	405.5	490
160	30	Niger	64.0	11.7	16.6	59.6	24.0	34.1	122.2	37.9	54.0	193.4	370
161	31	Madagascar	64.6	18.2	15.4	38.3	41.4	35.1	87.0	50.9	43.1	106.9	430

Source: ITU. GNI and PPP$ values are based on World Bank data.
Note: N/A – Not available.

Chart 3.11: Purchasing power-adjusted ICT prices in Africa, 2011





Source: ITU. PPP$ values are based on World Bank data.
Note: Zimbabwe is not included, since PPP$ values are not available.

anticipated entry of yet another operator, Globacom.[51] The situation was similar in Kenya in 2011, where a "price war"[52] was reinforced by the introduction of MNP and brought down the mobile-cellular prices offered by the market leader Safaricom by 62 per cent, the single largest drop in mobile prices worldwide.

Apart from MNP (see Box 3.4), regulators have other means of strengthening and deepening competition and ensuring that larger operators do not take advantage of their dominant market position. In some cases, this can actually mean that regulators set minimum prices, or limit promotional offers. In Uganda, for example, the Uganda

Communications Commission (UCC) intervened in 2011 to require operators to charge on-net rates of at least 70 per cent of interconnection rates, and to restrict promotional offers to a limited time period.[53]

In regard to the mobile-cellular sub-basket, Kenya and the LDCs Ethiopia, Eritrea and Gambia all have relatively low prices in PPP$ terms. The fact that Eritrea does well in terms of PPP$ has to be understood in relation to its low income level. The country has the lowest GNI per capita level of all countries included in the 2011 IPB, and while mobile prices may seem relatively inexpensive in comparison with other products and services, they remain unaffordable to large segments of the population. Indeed, in 2011 the mobile-cellular sub-basket price in Eritrea represented 42.8 per cent of average monthly GNI per capita. While countries like Kenya, Ghana and Gambia boast highly competitive mobile markets, Eritrea's and Ethiopia's mobile prices are set by the monopoly enterprises EriTel and Ethio Telecom, respectively.[54]

In a total of 14 countries in the region, including Swaziland, Cape Verde, Cameroon, Togo, Mozambique and Madagascar, the mobile-cellular sub-basket costs over PPP$ 30. Several of the countries with relatively high prices have only two mobile-cellular operators. MTN Swaziland competes with only one other mobile operator, as do the incumbent operators in Cameroon, Mozambique and Togo. With the exception of Swaziland, these countries have mobile-cellular penetration rates below the African average, suggesting that a more competitive market with more than two operators (at least) can bring down prices and increase penetration rates. With three operators, Madagascar's mobile-cellular market is more competitive, but suffers from the country's geographic characteristics (World Bank, 2011a). The country has a very low population density and thus a large mobile-cellular coverage gap, and its penetration rate, at 38 per cent in 2011, remains well below the African average of 53 per cent.

Although Cape Verde has the cheapest PPP$ fixed-broadband prices in the region, the price for mobile-cellular services – which has decreased with the liberalization of the market and the end of CV Movel's monopoly – remains relatively high, the mobile-cellular basket costing PPP$ 38.3. CV Movel reduced its on-net prices in order to retain current customers and encourage on-net traffic, while at the same time raising off-net rates, thus increasing the price customers pay when calling other operators.

In terms of the PPP$-adjusted fixed-broadband baskets, on the other hand, both Gambia and Eritrea, along with Sao Tomé and Principe and Togo, pay a relatively high price for high-speed Internet access. As small, least developed countries, they have in the past been bypassed by submarine cable projects, and a serious shortage of bandwidth led in turn to high prices for fixed-broadband usage.[55] This is also the case for a number of landlocked developing countries (LLDCs), such as Swaziland (which has the most expensive PPP$-adjusted fixed-broadband services in the region), Rwanda, Niger and Burkina Faso. Out of the ten countries with the highest relative PPP$-adjusted prices for fixed-broadband, four are LLDCs. In both Niger and Swaziland, where the price for monthly fixed-broadband prices well exceeds the average monthly GNI per capita level, international Internet bandwidth remains very low, at 210 and 512 Mbit/s, respectively.

For several countries, however, the situation is likely to improve soon. With the anticipated completion of the Africa Coast to Europe (ACE) submarine cable project in 2012, Gambia and Sao Tomé and Principe will receive their first landing stations and be connected to an international cable system, and Gambia will no longer be dependent on neighbouring Senegal for Internet bandwidth.[56] In Eritrea, Niger and Swaziland, on the other hand, bandwidth shortages are likely to persist, driving up prices and hampering Internet usage.[57]

The importance of the availability of international Internet bandwidth and its effect on wholesale and retail prices can also be observed in other countries. In Tanzania, the submarine cable expansions in 2009/2010 increased international Internet bandwidth from 300 Mbit/s in 2008 to 5 000 Mbit/s in 2011 and resulted in a drop in prices and unlimited download allowances for the ISP TTCL. Despite this price reduction, fixed broadband remains relatively expensive. Uganda, which has relatively cheap fixed-broadband prices in terms of PPP$, also benefited from the deployment of submarine cables on the East African coast. Over the last few years, international bandwidth capacity has more than tripled, helping to reduce fixed-broadband prices by about 50 per cent between 2009 and 2010.[58] Rwanda

has also taken advantage of the expansion of international Internet bandwidth to deploy a 2 300 km national fibre-optic backbone in 2010.[59] Still, the price for Rwandatel's fixed-broadband basket remains very high, at PPP$ 244. Rwanda displays one of the lowest fixed-broadband penetration rates, at 0.03 per cent.

The 2011 IPB results suggest that fixed-broadband services in the Africa region remain unaffordable for most people, and too high in most countries. Cape Verde is an exception. Despite is geographic location (isolation) and size, Cape Verde is relatively well connected and stands out with the cheapest broadband sub-basket in terms of PPP$, which is even cheaper than the mobile-cellular sub-basket. Prices in Cape Verde have fallen substantially over the past years with the opening of the telecommunication market and the entry of a second ISP, Cabocom, in 2008 (ITU, 2011c). The incumbent Cabo Verde Multimedia has since drastically reduced prices, particularly in the period 2010 to 2011.

The ICT Price Basket in the Americas

The 2011 ICT Price Basket values in the Americas range from 0.6 in the United States, which ranks tenth globally, to 36 in Cuba, ranked 142nd out of the 161 economies included in the IPB. Only the United States and Canada – the region's sole developed economies that stand out for their relatively high GNI per capita levels compared to other countries in the region – have an IPB value of below 1 per cent. The IPB represents less than 2 per cent of average monthly GNI per capita in Trinidad and Tobago, Bahamas, Costa Rica and Venezuela. In a total of 20 out of 34 countries in the region, the IPB represents less than 4 per cent of average income (Table 3.6).

While higher income economies tend to have relatively lower ICT prices, a number of countries offer relatively affordable ICT services in relation to what their average GNI per capita level would predict. Costa Rica, for example,

Table 3.6: IPB and sub-baskets (USD, PPP$ and as a percentage of GNI per capita), 2011, the Americas

Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket (USD)	Mobile-cellular sub-basket (USD)	Fixed-broadband sub-basket (USD)	Fixed-telephone sub-basket (PPP$)	Mobile-cellular sub-basket (PPP$)	Fixed-broadband sub-basket (PPP$)	Fixed-telephone sub-basket (% of GNI per capita)	Mobile-cellular sub-basket (% of GNI per capita)	Fixed-broadband sub-basket (% of GNI per capita)	Average annual GNI per capita, USD, 2010
10	1	United States	0.6	13.8	35.7	20.0	13.8	35.7	20.0	0.3	0.9	0.5	47'390
22	2	Canada	0.9	27.3	45.0	29.5	23.1	37.9	24.9	0.8	1.2	0.8	43'270
35	3	Trinidad & Tobago	1.2	19.5	13.7	12.5	32.6	23.0	21.0	1.5	1.1	1.0	15'380
37	4	Bahamas	1.2	16.3	17.5	30.0	18.8	20.2	34.6	0.9	1.0	1.7	20'610 *
40	5	Costa Rica	1.3	4.6	3.4	13.9	6.9	5.1	20.7	0.8	0.6	2.5	6'810
45	6	Venezuela	1.4	1.7	24.6	15.7	2.5	36.2	23.0	0.2	2.5	1.6	11'590
55	7	Uruguay	2.0	13.0	21.4	19.3	15.7	25.8	23.3	1.5	2.4	2.2	10'590
58	8	Panama	2.1	12.8	9.4	14.7	23.5	17.2	26.8	2.2	1.6	2.5	6'970
59	9	St. Kitts and Nevis	2.2	12.6	15.1	36.7	16.9	20.3	49.1	1.3	1.5	3.7	11'740
63	10	Mexico	2.4	18.9	17.0	18.2	30.1	27.0	28.9	2.6	2.3	2.5	8'890
70	11	Barbados	2.6	20.7	21.2	39.6	31.0	31.8	59.5	2.0	2.0	3.8	12'660 *
71	12	Chile	2.8	26.6	23.7	19.7	33.5	29.8	24.8	3.2	2.8	2.3	10'120
74	13	Antigua & Barbuda	2.8	12.8	25.3	54.9	19.5	38.6	83.6	1.2	2.3	5.0	13'170
77	14	Argentina	3.2	4.6	41.1	24.3	8.1	71.9	42.6	0.6	5.7	3.4	8'620
80	15	Grenada	3.5	13.4	17.1	29.4	19.1	24.3	41.8	2.3	3.0	5.1	6'930
82	16	Dominica	3.6	10.7	17.7	33.0	19.2	31.7	58.9	1.9	3.1	5.9	6'760
84	17	Saint Lucia	3.8	11.6	21.2	29.3	18.3	33.3	46.1	2.1	3.9	5.4	6'560
87	18	Colombia	3.8	7.1	22.2	23.7	10.7	33.7	36.0	1.5	4.8	5.2	5'510
89	19	Dominican Rep.	3.8	12.5	16.9	18.9	22.4	30.3	33.9	3.0	4.0	4.5	5'030
90	20	St. Vincent and the G.	3.9	10.9	16.8	33.6	18.6	28.8	57.6	2.1	3.2	6.4	6'300
92	21	Suriname	4.0	2.5	14.3	42.1	3.1	18.1	53.2	0.5	2.9	8.5	5'920
93	22	Brazil	4.1	23.0	57.2	16.9	24.1	59.9	17.7	2.9	7.3	2.2	9'390
94	23	El Salvador	4.2	6.9	13.1	15.8	13.4	25.5	30.8	2.4	4.7	5.6	3'380
97	24	Jamaica	4.6	12.9	12.9	29.0	19.0	18.9	42.7	3.2	3.2	7.3	4'800
99	25	Ecuador	4.8	6.9	17.1	22.6	13.9	34.2	45.2	2.2	5.3	7.0	3'850
101	26	Guyana	5.1	3.1	8.4	24.9	3.6	9.7	28.6	1.3	3.5	10.4	2'870
103	27	Paraguay	5.3	6.8	9.7	19.2	12.5	17.8	35.1	3.0	4.3	8.5	2'710
107	28	Guatemala	6.1	5.6	8.8	27.3	9.3	14.8	45.6	2.4	3.9	12.0	2'740
111	29	Peru	7.2	12.1	42.9	29.6	21.2	75.5	52.1	3.1	11.0	7.6	4'700
114	30	Honduras	9.0	6.3	17.0	19.0	12.3	32.9	36.8	4.1	10.9	12.2	1'870
118	31	Belize	10.5	19.6	31.0	49.7	32.3	51.3	82.1	6.2	9.8	15.6	3'810
123	32	Bolivia	13.4	23.7	11.3	25.5	58.0	27.6	62.5	15.7	7.5	16.9	1'810
125	33	Nicaragua	14.9	5.2	16.7	19.6	13.5	43.4	50.7	5.6	18.1	21.1	1'110
142	34	Cuba	36.0	0.3	36.3	1752.7	N/A	N/A	N/A	0.1	7.8	379.0	5'550 **

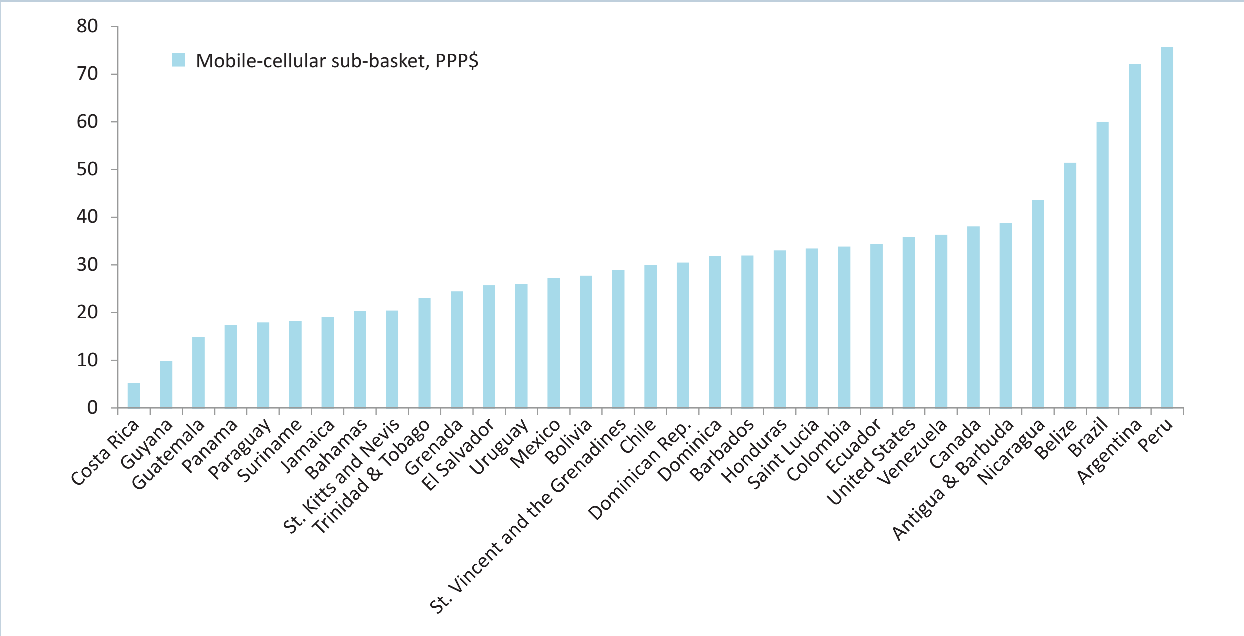
Source: ITU. GNI and PPP$ values are based on World Bank data.
Note: N/A – Not available. * 2009. **2008.

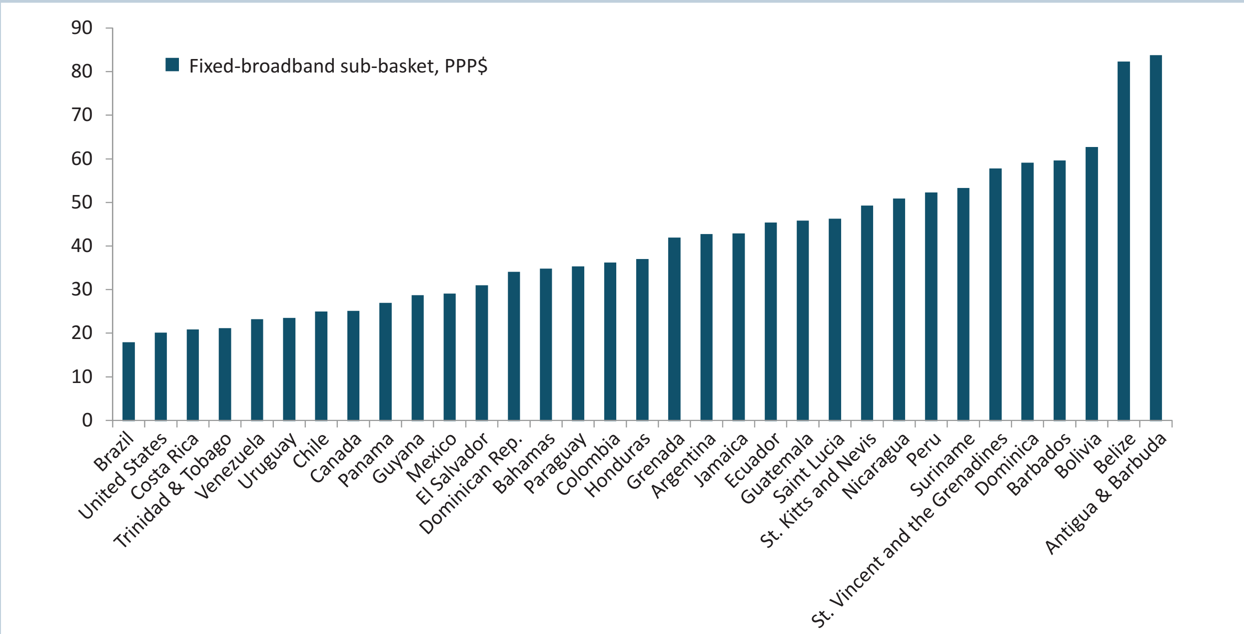
but also Panama and Mexico, have GNI per capita levels of below USD 10 000 but rank in the top ten economies with the most affordable ICT prices in the region.

Chart 3.12 provides a comparison of prices in terms of purchasing power parity (which takes into account the national buying power of a local currency), and highlights differences between countries in terms of their mobile-cellular and fixed-broadband services.

Within the region, both the United States and Canada, where ICT prices are very affordable and which rank high in terms of the overall IPB and the three sub-baskets, show relatively low PPP-adjusted fixed-broadband

Chart 3.12: Purchasing power-adjusted ICT prices in the Americas, 2011





Source: ITU. PPP$ values are based on World Bank data.
Note: Cuba is not included, since PPP$ values are not available.

basket values, yet relatively high PPP$ values for the mobile-cellular sub-basket. One explanation is that the mobile-cellular sub-basket is likely to overestimate the cost of mobile-cellular services (and the price per minute) because in both the United States and Canada the low-user basket is not representative. Indeed, the United States Wireless Association (CTIA) has repeatedly highlighted that on average US-Americans make a much higher number of calls from mobile phones than other countries, and that the price per minute of low-user packages is not representative, and is high, compared to the packages to which most US citizens subscribe.[60] A recent review of OECD mobile-cellular packages and rankings similarly showed that Canada ranks low (showing relatively high prices) in low-volume packages, but high (showing relatively low prices) in high-volume packages. In the OECD 30-calls basket (which is the one on which ITU's mobile-cellular sub-basket is based), Canada ranks second last, but it comes in at rank five on the OECD (high-volume) 900-minutes basket (Nordicity, 2011).

A number of countries, including Costa Rica, Panama and Trinidad and Tobago, have low PPP-adjusted prices for both mobile-cellular and fixed-broadband services. At PPP$ 5.1, Costa Rica's 2011 mobile-cellular sub-basket was the cheapest in the region, and the country's PPP$-adjusted fixed-broadband sub-basket, at PPP$ 20.7, is also relatively low. Even though until 2011 Costa Rica had one of the last remaining state telecommunication monopolies in Latin America (and, indeed, in the world), prices for ICT services have been relatively reasonable. Thus, the lack of liberalization does not seem to have had a negative impact on prices. On the other hand, penetration rates in Costa Rica have remained below average. Mobile-cellular penetration, for example, stood at only 65 per cent in 2010 and 92 per cent in 2011, as compared with the Latin American average of 95 and 103 per cent in 2010 and 2011, respectively. According to some analysts, this is due to a low level of network and customer service, as well as a lack of mobile-cellular prepaid services, which were only introduced in 2011.[61] While the newly introduced competition in the mobile-cellular market may not necessarily drive down prices, it could improve quality of service, and increase penetration rates.

Both Brazil and Venezuela have relatively high PPP$ mobile-cellular sub-baskets but at the same time offer relatively cheap fixed-broadband services. A growing number of countries are paying special attention to the spread and uptake of broadband networks and services, and have introduced national broadband plans, which are often linked to efforts to bring down prices and make broadband more affordable. Latin America is no exception. In Brazil and Venezuela, as well as in Costa Rica and Uruguay, there have been increasing government efforts to develop access to broadband networks, not only by introducing more entry-level broadband offers, but also by lowering prices. Government initiatives in Venezuela, Costa Rica and Uruguay are carried out through public operators, whereas in Brazil they are achieved through agreements with the private sector and targeted government policies, including by increasing competition in the wholesale market to reduce end user prices (Galperin 2012, ITU 2011d). More recently, Brazil has announced very specific regulatory directives to operators to bring down fixed-telephone and mobile-cellular call prices and increase uptake.[62]

Regulatory mechanisms, such as the introduction of mobile virtual network operators (MVNO) and the reduction of mobile termination rates (MTR), have been used across the region to boost competition, reduce some operators' market dominance and thereby bring down mobile-cellular prices. In Mexico, Cofetel was able to drastically reduce mobile termination rates at the end of 2011, which quickly resulted in lower retail prices and all operators announcing call price cuts.[63] This will exert a further positive impact on mobile-cellular prices in Mexico, which ranked 61st globally in the 2011 mobile-cellular sub-basket. Another market development which has started to spread in the region is the increasing introduction of MVNOs, an area where Latin America has traditionally lagged behind other regions. While in 2010 the Latin American market was home to about 15 per cent of the world's mobile-cellular subscriptions, it represented less than one per cent of the global MVNO subscriber base.[64] In early 2010, Chile was the only country in the region with an approved MVNO-specific regulation, although some MVNOs were operating in Brazil, Colombia, Ecuador and Mexico.[65] Since then, more countries have started to regulate MVNOs and are encouraging the entrance of alternative operators, which is likely to further enhance competition.[66]

The ICT Price Basket in the Arab States

The 2011 ICT Price Basket values in the Arab States range considerably, between 0.5 in Qatar and United Arab Emirates, which rank fourth and sixth globally, to 45.9 in Comoros, ranked 152nd out of 161 economies. The large disparities in IPB values and global rankings reflect the region's diversity in terms of income and development levels, with ICT services relatively more affordable in high-income economies.

All of the economies in the Arab States region that rank in the top quarter (i.e. the top 40) of the global IPB (Qatar, United Arab Emirates, Bahrain, Saudi Arabia, Oman) have relatively high income levels. Qatar, which ranks fourth globally, has the most affordable prices in the region, followed by United Arab Emirates, Bahrain, Oman and Saudi Arabia, where the IPB represents less than 1.5 per cent of average monthly GNI per capita. In Lebanon, Tunisia, Egypt, Algeria and Jordan, the IPB represents less than 4 per cent of GNI per capita. ICT services remain largely unaffordable (representing some 20 per cent of GNI per capita, or more) in Comoros, Iraq, Mauritania and Djibouti (Table 3.7).

A comparison of prices in terms of purchasing power parity (Chart 3.13), which takes into account the national buying power of a local currency, highlights some interesting differences between countries as well as between mobile-cellular and fixed-broadband services. While United Arab Emirates has a low PPP$-adjusted mobile-cellular sub-basket, the country's fixed-broadband PPP$ prices are high compared with other countries in the region. Jordan fares well, both in terms of the PPP$-adjusted mobile-cellular sub-basket and in terms of fixed-broadband PPP$ prices. The country has a highly competitive and developed telecommunication sector, in particular in the mobile-cellular market, where three mobile network operators and one MVNO are competing for customers. Growing competition in the deployment of 3G and WiMAX is also putting more and more pressure on operators to offer competitive prices, and Jordan is often cited as one of the most competitive markets in the region.[67]

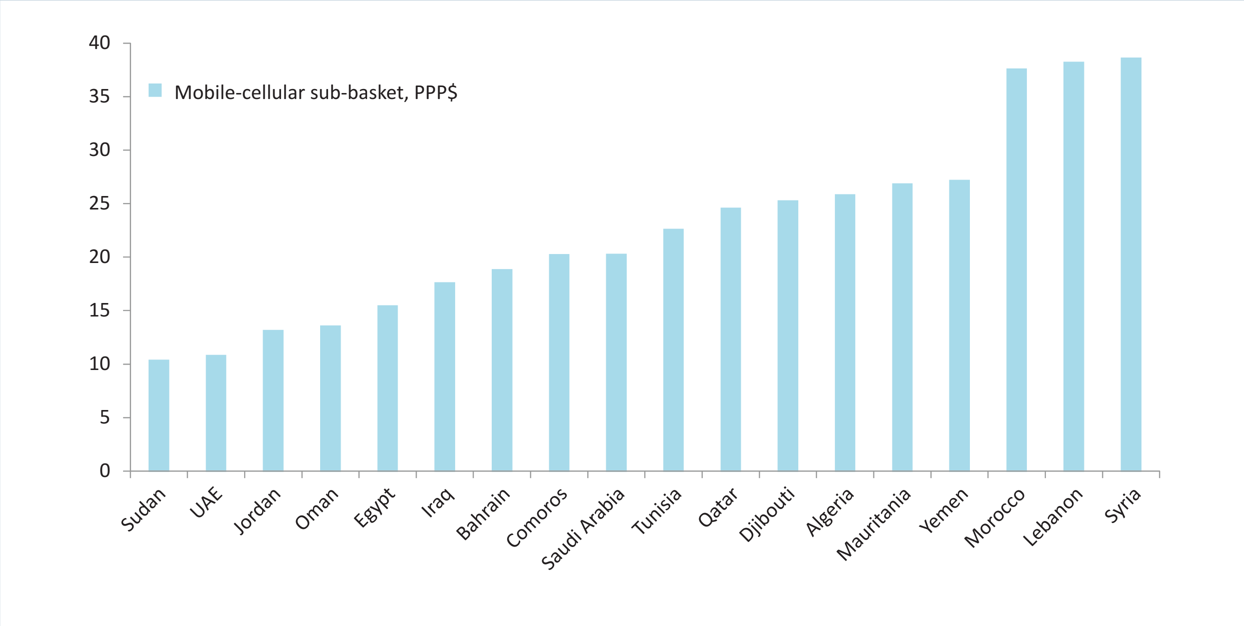
Another country that can be highlighted for its relatively low mobile-cellular sub-basket is Oman, where intense competition has helped push down prices. Oman was one of the first countries in the region to introduce MVNO in 2009, and today counts no fewer than five resellers active in the relatively small market of less than 3 million inhabitants.[68] As highlighted earlier in this chapter, Oman has made great strides in cutting mobile-cellular prices between 2010 and 2011, by when the country had one of the lowest PPP$-adjusted mobile-cellular sub-baskets in the region. PPP$-adjusted prices for mobile-cellular services are also low in Sudan, Egypt, Iraq and Bahrain, and are highest in Syria, Morocco and Lebanon.

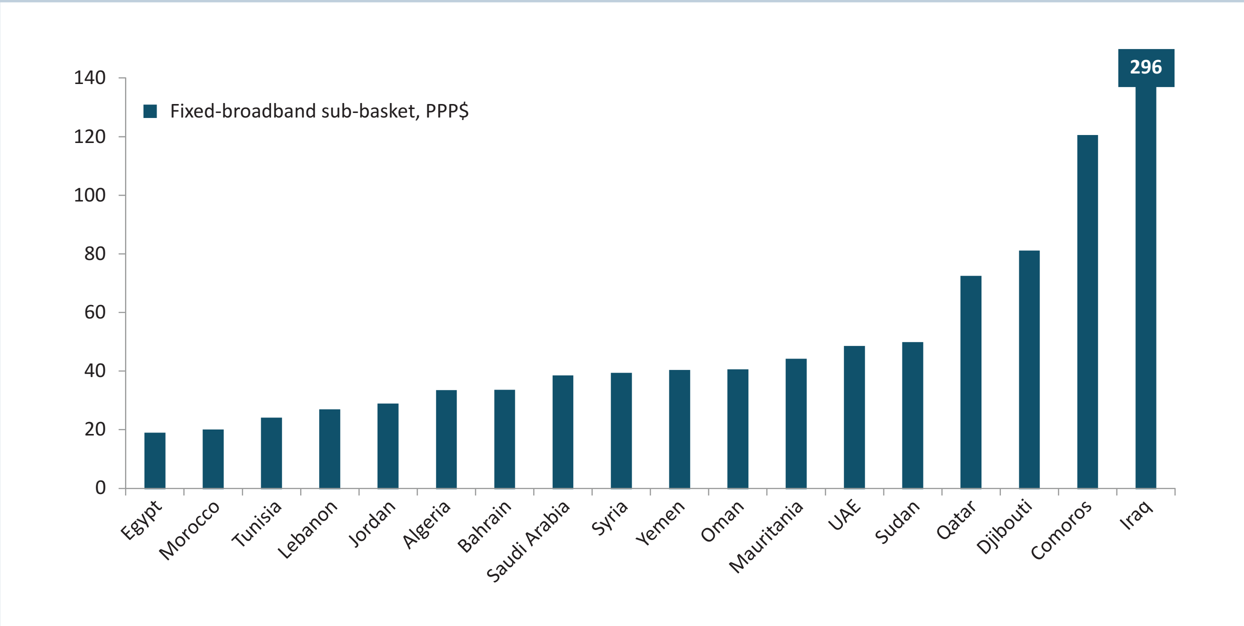
Table 3.7: IPB and sub-baskets (USD, PPP$ and as a percentage of GNI per capita), 2011, Arab States

Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Average annual GNI per capita, USD, 2010	
				USD			PPP$			% of GNI per capita				
4	1	Qatar	0.5	9.1	18.7	54.9	11.9	24.6	72.3	0.2	0.3	0.9	71'008	*
6	2	United Arab Emirates	0.5	4.1	9.1	40.6	4.9	10.8	48.3	0.1	0.3	1.2	41'930	*
15	3	Bahrain	0.7	4.7	15.0	26.6	5.9	18.8	33.3	0.2	0.7	1.3	25'420	**
30	4	Oman	1.0	13.1	8.7	25.9	20.4	13.5	40.3	0.9	0.6	1.7	18'260	*
41	5	Saudi Arabia	1.3	13.2	14.1	26.6	18.9	20.3	38.2	1.0	1.0	2.0	16'190	*
64	6	Lebanon	2.5	11.7	25.2	17.6	17.8	38.2	26.7	1.6	3.4	2.4	8'880	
66	7	Tunisia	2.5	5.8	10.0	10.5	13.1	22.6	23.8	1.7	2.9	3.0	4'160	
75	8	Egypt	2.9	3.1	6.6	8.0	7.3	15.4	18.7	1.6	3.3	4.0	2'420	
79	9	Algeria	3.4	6.3	13.8	17.8	11.7	25.8	33.3	1.7	3.7	4.8	4'450	
91	10	Jordan	3.9	9.4	10.4	22.6	11.9	13.1	28.6	2.6	2.9	6.2	4'340	
100	11	Morocco	5.1	2.3	22.2	11.7	3.8	37.6	19.8	0.9	9.4	4.9	2'850	
109	12	Syria	6.4	1.3	21.3	21.6	2.3	38.6	39.1	0.5	9.3	9.4	2'750	
119	13	Yemen	10.8	0.9	11.3	16.7	2.3	27.2	40.2	1.1	12.6	18.7	1'070	*
121	14	Sudan	12.9	6.0	6.1	29.0	10.3	10.4	49.6	5.7	5.7	27.4	1'270	
126	15	Djibouti	19.8	8.1	13.0	41.8	15.7	25.3	80.9	7.6	12.3	39.5	1'270	*
127	16	Mauritania	21.7	18.0	14.4	23.5	33.5	26.8	43.9	20.9	16.8	27.4	1'030	
141	17	Iraq	35.5	0.4	12.5	211.3	0.5	17.6	296.7	0.2	6.4	108.3	2'340	
152	18	Comoros	45.9	10.0	13.5	80.2	15.0	20.2	120.3	16.0	21.6	128.3	750	

Source: ITU. GNI and PPP$ values are based on World Bank data.
Note: * 2009. **2008.

Chart 3.13: Purchasing power-adjusted ICT prices in the Arab States, 2011





Source: ITU. PPP$ values are based on World Bank data.

At the same time, both Morocco and Lebanon, but also Egypt and Tunisia, have low PPP$-adjusted fixed-broadband sub-baskets in comparison with other countries in the region. In Lebanon, fixed-broadband prices fell substantially following an increase in international Internet bandwidth, combined with a state order mandating price cuts and speed increases in July 2011. Following these regulatory interventions, a study carried out by the Lebanese Telecommunication Regulatory Authority (TRA) showed that the country was able to offer fixed-broadband services at prices below the regional average.[69]

Finally, PPP$-adjusted fixed-broadband prices in both United Arab Emirates and Qatar remain relatively high,

above PPP$ 40, but – given the high income levels in these countries – both countries rank well in terms of the fixed-broadband sub-basket and hence affordability of the service. This is not the case for Comoros and Djibouti, where fixed-broadband services are even more costly in PPP$-adjusted values, and also expensive in terms of income levels, and thus affordability. Both countries rank very low on the fixed-broadband sub-basket.

The ICT Price Basket in Asia and the Pacific

The Asia and the Pacific region is home to some of the countries ranked at the very top of the global IPB, but includes countries that rank at the bottom, too. The regional IPB values range from 0.3 in Macao (China) – which ranks first not only in the region but also globally – to 39.4 in Kiribati, ranked 148th on the global IPB. With the exception of Maldives, the economies with the highest income levels, including Singapore, Japan, Australia, Republic of Korea and Australia, also occupy the highest regional IPB ranks.

In all high-income economies in the Asia and the Pacific region, the IPB represents less than 2 per cent of monthly GNI per capita, and a number of those countries have almost the same IPB values, suggesting not only that services have become largely affordable but also that differences in the price and affordability of services between many high-income economies are small.

The list of countries at the bottom of the IPB is dominated by low-income and lower-middle-income economies. It is also noteworthy that small island developing states (SIDS) tend to have relatively high ICT prices: with the exception of Fiji, which has an IPB of 5.2, all other SIDS have IPB values that range from around ten (in Tonga and Micronesia) to a high of 36 and 39 in Vanuatu and Kiribati, respectively. Landlocked countries, including Lao P.D.R. and Nepal, also have very high prices. In Lao P.D.R. and Kiribati, the fixed-broadband sub-basket exceeds the average monthly GNI per capita level (Table 3.8). In SIDS and LLDCs, fixed-broadband services are very limited and prices often remain largely unaffordable because

Table 3.8: IPB and sub-baskets (USD, PPP$ and as a percentage of GNI per capita), 2011, Asia and the Pacific

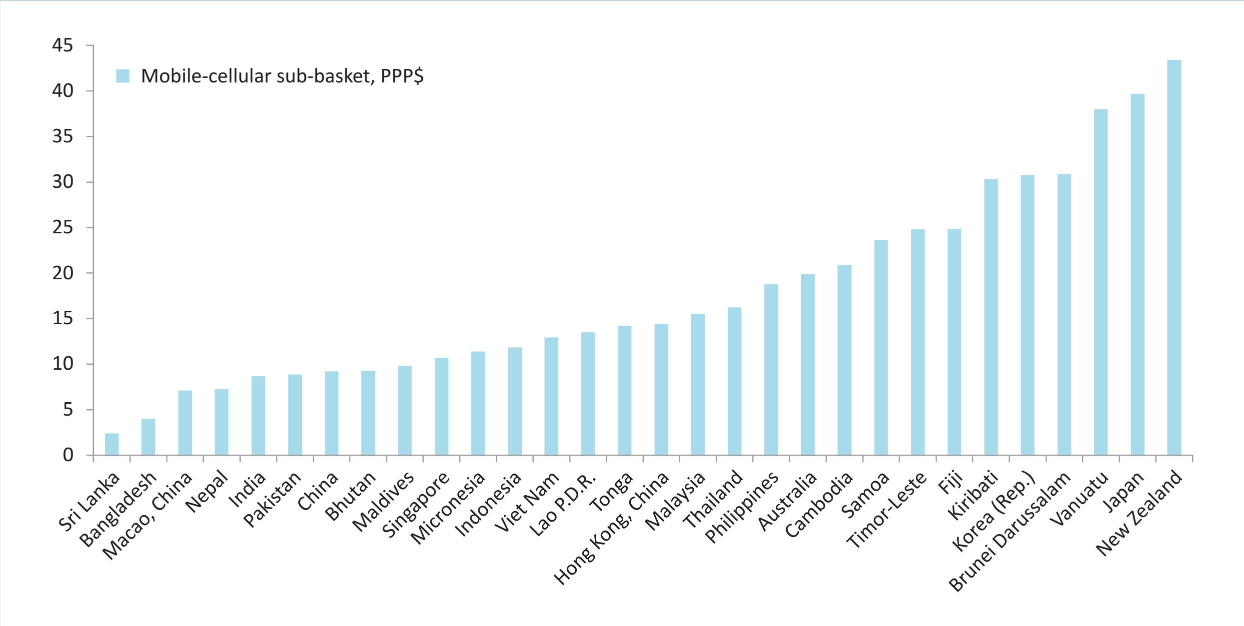
Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket (USD)	Mobile-cellular sub-basket (USD)	Fixed-broadband sub-basket (USD)	Fixed-telephone sub-basket (PPP$)	Mobile-cellular sub-basket (PPP$)	Fixed-broadband sub-basket (PPP$)	Fixed-telephone sub-basket (% of GNI per capita)	Mobile-cellular sub-basket (% of GNI per capita)	Fixed-broadband sub-basket (% of GNI per capita)	Average annual GNI per capita, USD, 2010
1	1	Macao, China	0.3	8.4	5.7	8.5	10.4	7.0	10.5	0.3	0.2	0.3	34'880 *
3	2	Singapore	0.4	8.2	8.1	26.2	10.7	10.6	34.2	0.2	0.2	0.8	40'070
8	3	Hong Kong, China	0.6	14.2	9.8	21.2	20.7	14.4	31.1	0.5	0.4	0.8	32'780
25	4	Japan	1.0	26.4	50.4	24.2	20.8	39.6	19.0	0.8	1.4	0.7	41'850
26	5	Brunei Darussalam	1.0	11.7	18.3	48.3	19.7	30.8	81.5	0.4	0.7	1.8	31'800 *
29	6	Australia	1.0	29.5	27.7	55.3	21.1	19.8	39.6	0.8	0.8	1.5	43'590 *
32	7	Korea (Rep.)	1.1	5.8	21.8	25.7	8.2	30.7	36.3	0.4	1.3	1.6	19'890
44	8	Maldives	1.4	4.1	6.8	9.3	5.8	9.7	13.2	0.8	1.4	1.9	5'750
48	9	New Zealand	1.7	33.0	47.2	40.5	30.4	43.3	37.2	1.4	2.0	1.7	28'770 *
50	10	Sri Lanka	1.8	3.4	1.1	5.5	7.2	2.3	11.6	1.8	0.6	2.9	2'240
51	11	Malaysia	1.8	5.1	8.8	20.5	9.1	15.5	36.0	0.8	1.4	3.2	7'760
67	12	China	2.5	3.9	5.3	17.8	6.6	9.1	30.4	1.1	1.5	5.0	4'270
78	13	Thailand	3.4	6.0	8.7	20.2	11.1	16.2	37.5	1.7	2.5	5.8	4'150
85	14	India	3.8	2.9	3.5	6.1	7.2	8.6	14.9	2.7	3.2	5.5	1'330
86	15	Bhutan	3.8	3.4	3.6	10.9	8.6	9.2	27.8	2.2	2.3	7.0	1'870
102	16	Fiji	5.2	8.5	19.8	18.7	10.6	24.8	23.5	2.8	6.5	6.2	3'630
104	17	Indonesia	5.5	4.6	8.1	21.6	6.8	11.8	31.5	2.2	3.9	10.4	2'500
106	18	Viet Nam	6.0	2.2	4.8	10.5	5.9	12.8	28.1	2.3	4.9	10.8	1'160
110	19	Bangladesh	6.5	1.5	1.6	8.3	3.8	3.9	20.4	2.6	2.7	14.3	700
112	20	Pakistan	8.2	4.1	3.3	14.2	10.9	8.8	37.7	4.7	3.8	16.2	1'050
113	21	Philippines	9.0	14.4	10.1	22.1	26.7	18.7	41.1	8.4	5.9	12.9	2'060
116	22	Tonga	9.7	6.4	11.0	62.3	8.2	14.1	79.9	2.3	4.0	22.8	3'280
117	23	Micronesia	10.1	10.0	9.1	50.0	12.4	11.3	62.2	4.4	4.0	22.0	2'730
120	24	Samoa	12.1	12.0	17.6	60.8	16.0	23.5	81.1	4.8	7.1	24.3	3'000
129	25	Timor-Leste	23.9	17.2	16.6	99.0	25.6	24.7	147.3	9.3	9.0	53.5	2'220
130	26	Cambodia	24.3	7.9	7.6	30.0	21.7	20.8	82.4	12.6	12.1	48.0	750
132	27	Nepal	27.2	3.4	3.2	23.3	7.6	7.2	51.9	9.3	8.7	63.4	440 *
143	28	Vanuatu	36.0	41.0	25.4	171.0	61.1	37.9	254.8	18.6	11.6	77.7	2'640
144	29	Lao P.D.R.	37.4	4.6	6.2	97.2	9.9	13.4	211.8	5.2	7.0	111.0	1'050
148	30	Kiribati	39.4	11.5	18.7	383.1	18.6	30.2	618.9	6.9	11.2	228.7	2'010

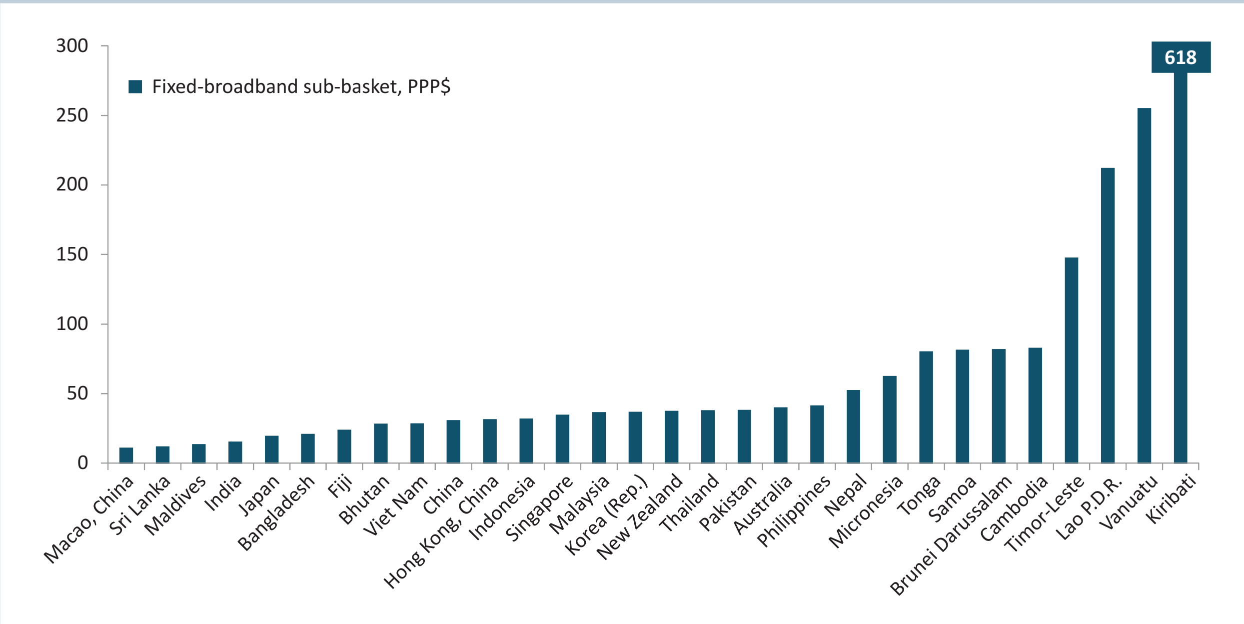
Source: ITU. GNI and PPP$ values are based on World Bank data.
Note: * 2009.

of limited access to international Internet bandwidth, among other factors.

The PPP-adjusted prices of mobile-cellular and fixed-broadband Internet services, which take into account the national buying power of a local currency, show that a number of developing countries with relatively low GNI per capita levels – including Sri Lanka, Bangladesh, Nepal, India and Pakistan – are offering mobile-cellular services at a relatively low price (Chart 3.14). In Sri Lanka and Bangladesh, the mobile-cellular sub-basket costs less than PPP$ 4, compared with ten times this amount in Japan and New Zealand. Mobile-cellular prices in Sri Lanka's and Bangladesh's highly competitive mobile markets continue to drop (by no

Chart 3.14: Purchasing power-adjusted ICT prices in the Asia and the Pacific, 2011





Source: ITU. PPP$ values are based on World Bank data.

less than 43 and 32 per cent, respectively, between 2010 and 2011), and in 2011 Sri Lanka ranks 14th in the global mobile-cellular sub-basket. Both countries have five mobile operators, with a mix of national and internationally-backed operators, but on account of tough competition have recorded relatively small (and decreasing) average revenue per user (ARPU).[70]

India, where customers are highly price-sensitive and a large number of operators increasingly compete for low-income, rural and semi-urban customers, is known to have some of the lowest ARPU levels in the world.[71] The Telecommunication Regulatory Authority of India (TRAI) has also been eager to make price plans and packages as transparent as possible and operators are obliged to publish plans in different formats and in a way that allows customers to easily make comparisons.[72]

In China, mobile-cellular prices are also relatively low (in PPP$ terms) since the country, which has a total of three mobile-cellular operators, can leverage a very large population base and exploit economies of scale. In the largest mobile-cellular market in the world in terms of subscriptions (the country reached over 1 billion mobile-cellular subscriptions in early 2012), China Mobile, which is state-owned, accounts for about two-thirds of mobile-cellular subscriptions and can leverage the resulting economies of scale.[73] In terms of 3G subscriptions, where China Mobile was granted the least mature of the (home-grown) 3G standards (TD-SCDMA), its market share is much lower and although this has meant that it has lost out on high-end (3G data) users that tend to spend more money, the company is likely to continue pursuing a strategy of acquiring large numbers of customers, including in rural and remote areas, *inter alia* by offering relatively low prices.[74]

The countries with the relatively highest PPP$-adjusted mobile-cellular baskets are New Zealand, Japan and Vanuatu, where the 2011 mobile-cellular sub-basket cost between PPP$ 38 and PPP$ 43. In the same way as for other high-income developed economies, the ITU mobile-cellular sub-basket, being a low-user basket, is likely to overestimate the cost of mobile-cellular services in New Zealand and Japan, since most users opt for higher-usage packages that are cheaper on a per-minute basis. The same limitation is also likely to apply in the case of the Republic of Korea, one of the world's most mature mobile-cellular markets.

A number of countries that are offering relatively low mobile-cellular prices, including Sri Lanka, Maldives, India and Bangladesh, also rank at the top of the PPP-adjusted fixed-broadband sub-basket. In Sri Lanka, which ranks just behind Macao (China), the fixed-broadband sub-basket costs PPP$ 11.6, compared with PPP$ 14.9 in India and PPP$ 20.4 in Bangladesh, and much more in most other developing countries in the region. As in the case of its mobile market, Sri Lanka has a very dynamic broadband market, with different fixed and mobile operators providing broadband services through different technologies (WiMAX, ADSL and HSDPA) and via various packages, depending on users' needs. The government was able to foster competition and thus help reduce prices by introducing 3G mobile-broadband networks early on, but also by regularly publishing network quality reports and compiling and comparing fixed- and mobile-broadband prices and speeds. In addition, Sri Lanka has access to international Internet bandwidth via a number of international fibre-optic cables, including SE-ME-WE 3 and 4 and FLAG.[75]

PPP$-adjusted prices for fixed-broadband services in 2011 are also quite low in Viet Nam and China, where they stood at PPP$ 28.1 and 30.4, respectively. In Viet Nam, increasing demand for broadband Internet access has led to economies of scale and lower prices, further driven by a high degree of competition from 3G operators, which were able to launch services towards the end of 2009 (Tuan, 2011).

The countries with the highest PPP$ fixed-broadband prices in Asia are Kiribati, Vanuatu and Timor Leste, which are all SIDS, and Lao P.D.R., which is an LLDC. In these countries, the fixed-broadband basket exceeds PPP$ 100, making it largely unaffordable for large parts of the population. Other SIDS with high prices are Samoa, Tonga and Micronesia. Both SIDS and LLDCs often face a lack of international Internet bandwidth, resulting in relatively high fixed-broadband prices.

The ICT Price Basket in the Commonwealth of Independent States

The 2011 ICT Price Basket values in the Commonwealth of Independent States (CIS) vary from 1.1 in the Russian Federation to 38 in Tajikistan. The Russian Federation, ranked 31st globally, is the only country in the region ranking in the top 50 on the global IPB, and Uzbekistan and Tajikistan

rank low on a global level, in 140th and 146th position, respectively. The regional ranking is closely linked to income levels, countries with relatively higher GNI per capita levels finding themselves at the top and those with relatively lower GNI per capita levels at the bottom.

In seven out of the ten CIS countries included in the IPB, their 2011 IPB is below five, suggesting that services have become relatively affordable in a majority of these countries. In Moldova, the IPB represented 5.9 per cent of the country's average GNI per capita. ICT services remain largely unaffordable in Uzbekistan and Tajikistan, the only two countries in the region where the price of the fixed-broadband sub-basket exceeds the monthly GNI per capital level (Table 3.9).

A comparison of prices in terms of purchasing power parity (Chart 3.15), which takes into account the national buying power of a local currency, highlights that some countries in the CIS, in particular Ukraine, are doing relatively well when prices are expressed in PPP$. In some countries, such as Georgia and Moldova, fixed-broadband prices are relatively low compared to mobile-cellular services, while the contrary is true for Uzbekistan, which has low PPP$-adjusted mobile-cellular prices but high PPP$-adjusted fixed-broadband prices.

Ukraine has a very competitive mobile-cellular market, with six mobile network and mobile virtual network operators – including Ukrtelecom, the state-owned national operator privatized in 2011 – competing for the country's 45 million inhabitants. Broadband competition is also increasing, with cross-platform competition through DSL, cable and increasingly fibre as well as mobile-broadband.

In Uzbekistan, which has the lowest PPP$-adjusted prices in the mobile-cellular sub-basket in the region, competition is also intense, with five operators – all owned by foreign investors – competing for the country's 28 million inhabitants. Despite relatively low income levels, this lower-middle-income country was one of the first in the region to launch mobile-cellular services in the early 1990s and also the first in the region to launch a commercial LTE network.[76] The price of a monthly fixed-broadband connection, on the other hand, remains very high in Uzbekistan, at PPP$ 452.8, and well above the average monthly GNI per capita, making it clearly unaffordable for the majority of people. Consequently, fixed-broadband penetration remains very low, at 0.5 per cent at end 2011. In the region, only Tajikistan, where the entry-level fixed-broadband sub-basket costs close to PPP$ 1 000 per month (representing more than five times the average monthly GNI per capita), is more expensive, and its fixed-broadband penetration (at 0.07 per cent) is insignificant.

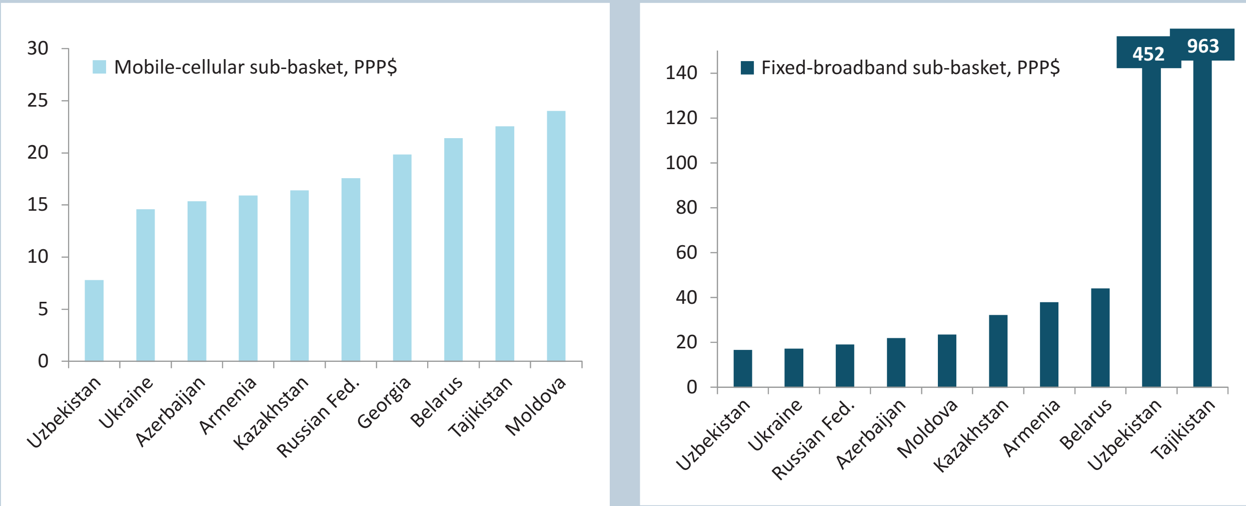
In landlocked Moldova, the limited amount of international Internet bandwidth used to be a major bottleneck for broadband access, particularly because until April 2010 international connectivity was under the monopoly of the state-owned incumbent Moldtelecom. Once the market was liberalized, a number of other companies, including the mobile operator Orange, installed cross-border fibre-optic networks to neighbouring Romania.[77] Consequently, the

Table 3.9: IPB and sub-baskets (USD, PPP$ and as a percentage of GNI per capita), 2011, CIS

Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Average annual GNI per capita, USD, 2010
				USD			PPP$			% of GNI per capita			
31	1	Russian Federation	1.1	7.0	9.2	9.9	13.2	17.5	18.7	0.8	1.1	1.2	9'900
52	2	Azerbaijan	1.8	2.5	8.8	12.5	4.3	15.3	21.6	0.6	2.0	2.8	5'330
53	3	Belarus	1.9	1.3	8.8	18.1	3.2	21.4	43.8	0.3	1.8	3.6	5'950
57	4	Kazakhstan	2.0	2.7	12.2	23.9	3.7	16.3	31.9	0.4	1.9	3.8	7'590
62	5	Ukraine	2.3	2.9	6.5	7.6	6.6	14.5	16.9	1.2	2.6	3.0	3'000
76	6	Georgia	3.1	2.3	10.2	8.4	4.3	19.8	16.3	1.0	4.6	3.8	2'690
95	7	Armenia	4.3	4.2	8.8	21.0	7.5	15.8	37.6	1.6	3.3	7.9	3'200
105	8	Moldova	5.9	1.9	12.6	12.2	3.7	24.0	23.1	1.3	8.4	8.1	1'810
140	9	Uzbekistan	34.7	0.9	3.4	200.0	2.0	7.7	452.8	0.8	3.2	187.5	1'280
146	10	Tajikistan	38.0	0.9	8.5	362.5	2.5	22.5	963.5	1.4	12.7	543.7	800

Source: ITU. GNI and PPP$ values are based on World Bank data.

Chart 3.15: Purchasing power-adjusted ICT prices in the CIS, 2011



Source: ITU. PPP$ values are based on World Bank data.

country's international Internet bandwidth grew from 24 GB to 123 GB between 2009 and 2011, and this exerted an immediate and positive impact on the availability, quality and (wholesale and retail) price of broadband services.[78]

Similarly, the Russian Federation, by far the largest country in the region in terms of population and land area, has increased its international Internet bandwidth significantly, from 300 GB in 2009 to 2 233 GB in 2011, while bringing down prices to PPP$ 18.7 in 2011 from PPP$ 27.5 two years before. The Russian government has made broadband deployment an important policy priority, and created an open and competitive regulatory framework which has helped reduce prices and expand access. At the same time, the government uses subsidies and public-private partnerships to connect remote and rural areas such as the Far East and Siberia – where private operators are unlikely to offer services – including through the deployment of satellite and other wireless technologies.[79]

The ICT Price Basket in Europe

Most of the European countries rank high in the 2011 IPB and Norway, Luxembourg, Denmark and Sweden are among the top ten countries globally. A total of 13 European countries rank in the top 20 of the global IPB. In all the 38 European countries included in the 2011 IPB, the IPB represents less than 5 per cent of GNI per capita, and in almost half of all European countries it represents ≤ 1 per cent of GNI per capita (Table 3.10).

The regional IPB ranking is headed by Norway, with an IPB of 0.4, and closed by Albania, with a value of 4.6. The bottom of the list is made up of Eastern and Southern European countries, including Turkey. In Europe, the mobile-cellular sub-basket is the most expensive of the three sub-baskets (see Chart 3.10), and the only one that in some countries (Albania, Bulgaria and TFYR Macedonia) exceeds 5 per cent of GNI per capita. The price of the fixed-broadband sub-basket as a percentage of GNI per capita is highest in Serbia, but stays under the 5 per cent threshold. The fixed-telephone sub-basket is the least expensive sub-basket in Europe, with a majority of countries having IPB values of one, or less. All three services are relatively affordable across Europe, particularly compared with other regions and countries outside Europe.

In Europe, the range of IPB values is by far the smallest of all regions, and many countries actually register the same or very similar IPB values. This confirms that the differences in affordability between most countries are relatively small, reflecting homogeneity in the region. The vast majority of countries in the region are high-income, developed countries. Nevertheless, the link between income levels and affordability

Table 3.10: IPB and sub-baskets (USD, PPP$, and as a percentage of GNI per capita), 2011, Europe

Global IPB rank	Regional IPB rank	Country	IPB	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Fixed-telephone sub-basket	Mobile-cellular sub-basket	Fixed-broadband sub-basket	Average annual GNI per capita, USD, 2010
				USD			PPP$			% of GNI per capita			
2	1	Norway	0.4	23.8	14.6	49.1	16.1	9.9	33.2	0.3	0.2	0.7	84'290
5	2	Luxembourg	0.5	26.9	26.0	38.1	22.4	21.6	31.7	0.4	0.4	0.6	77'160
7	3	Denmark	0.5	28.9	7.9	43.9	20.6	5.6	31.3	0.6	0.2	0.9	59'050
9	4	Sweden	0.6	25.5	14.4	33.1	20.3	11.5	26.4	0.6	0.3	0.8	50'110
11	5	Switzerland	0.6	31.6	45.2	32.7	21.7	31.2	22.5	0.5	0.8	0.5	71'530
12	6	Finland	0.6	25.5	13.1	35.4	21.2	10.9	29.3	0.6	0.3	0.9	47'720
13	7	Austria	0.7	25.3	13.5	39.3	22.6	12.0	35.0	0.6	0.3	1.0	47'060
14	8	Cyprus	0.7	23.4	7.9	20.7	25.5	8.6	22.6	1.0	0.3	0.8	29'430
16	9	Iceland	0.8	19.0	17.9	26.8	16.8	15.9	23.7	0.7	0.7	1.0	32'710
17	10	Netherlands	0.8	32.5	33.2	32.9	29.5	30.1	29.8	0.8	0.8	0.8	49'050
18	11	Belgium	0.8	31.5	37.6	25.2	27.7	33.0	22.1	0.8	1.0	0.7	45'910
19	12	Israel	0.9	17.4	34.8	8.8	17.3	34.6	8.7	0.8	1.5	0.4	27'170
20	13	Germany	0.9	27.2	31.5	39.4	25.4	29.4	36.8	0.8	0.9	1.1	43'110
21	14	Ireland	0.9	26.3	37.3	32.9	23.1	32.8	28.9	0.8	1.1	1.0	41'000
23	15	Italy	0.9	25.8	30.9	26.5	24.2	29.0	24.8	0.9	1.1	0.9	35'150
24	16	United Kingdom	0.9	33.1	38.0	20.0	33.1	37.9	20.0	1.0	1.2	0.6	38'370
27	17	France	1.0	26.6	49.2	31.6	22.9	42.5	27.2	0.8	1.4	0.9	42'390
28	18	Malta	1.0	10.4	20.6	18.2	14.0	27.6	24.5	0.7	1.3	1.1	19'270
33	19	Lithuania	1.2	12.9	9.6	10.3	21.7	16.1	17.2	1.4	1.0	1.1	11'390
34	20	Greece	1.2	23.8	36.6	19.2	25.1	38.5	20.2	1.1	1.6	0.9	26'940
36	21	Latvia	1.2	10.1	12.5	12.9	15.7	19.3	20.0	1.0	1.3	1.3	11'620
38	22	Slovenia	1.3	17.7	23.9	34.2	21.1	28.5	40.8	0.9	1.2	1.7	23'860
42	23	Portugal	1.4	23.6	23.2	27.6	28.3	27.8	33.1	1.3	1.3	1.5	21'880
43	24	Spain	1.4	31.1	47.2	30.9	32.9	49.9	32.7	1.2	1.8	1.2	31'750
46	25	Croatia	1.5	16.9	15.6	18.2	23.9	22.0	25.8	1.5	1.3	1.6	13'870
47	26	Estonia	1.6	11.9	23.3	21.1	N/A	N/A	N/A	1.0	1.9	1.7	14'460
49	27	Poland	1.7	20.6	12.6	19.4	33.4	20.5	31.5	2.0	1.2	1.9	12'440
54	28	Slovakia	2.0	17.9	38.5	26.1	26.3	56.6	38.4	1.3	2.7	1.9	16'830
56	29	Czech Republic	2.0	26.8	33.4	31.2	37.4	46.5	43.5	1.8	2.2	2.1	17'890
60	30	Hungary	2.2	22.1	27.6	21.7	34.8	43.4	34.1	2.1	2.6	2.0	12'850
61	31	Romania	2.2	12.5	22.2	9.1	23.6	42.1	17.3	1.9	3.4	1.4	7'840
65	32	Turkey	2.5	14.5	33.8	13.8	22.1	51.6	21.1	1.8	4.1	1.7	9'890
68	33	Montenegro	2.5	7.8	16.5	18.4	15.8	33.3	37.0	1.4	2.9	3.3	6'750
69	34	Serbia	2.6	6.6	9.8	19.8	14.0	20.8	42.2	1.4	2.1	4.2	5'630
73	35	Bosnia and Herzegovina	2.8	9.8	15.9	7.9	19.3	31.1	15.4	2.5	4.0	2.0	4'770
83	36	Bulgaria	3.7	11.3	32.9	13.4	24.8	72.2	29.5	2.2	6.3	2.6	6'270
88	37	TFYR Macedonia	3.8	11.9	19.1	12.8	29.9	48.0	32.2	3.1	5.0	3.4	4'570
96	38	Albania	4.6	7.6	25.8	11.7	18.0	60.9	27.6	2.3	7.8	3.5	3'960

Source: ITU. GNI and PPP$ values are based on World Bank data.
Note: N/A – Not available.

of ICT services is also evident in this region. Albania, the country with the lowest GNI per capita, ranks last, while Norway, which has the highest GNI per capita, ranks first. The eight economies ranked at the bottom of the regional IPB are all upper-middle-income economies, while all the countries ranked above, with the exception of Latvia and Lithuania, are high-income economies. The countries that rank higher than their GNI per capita would predict include Malta, Israel, Iceland and Cyprus. The latter two can even be found in the regional top ten and the global top 20 (Table 3.10).

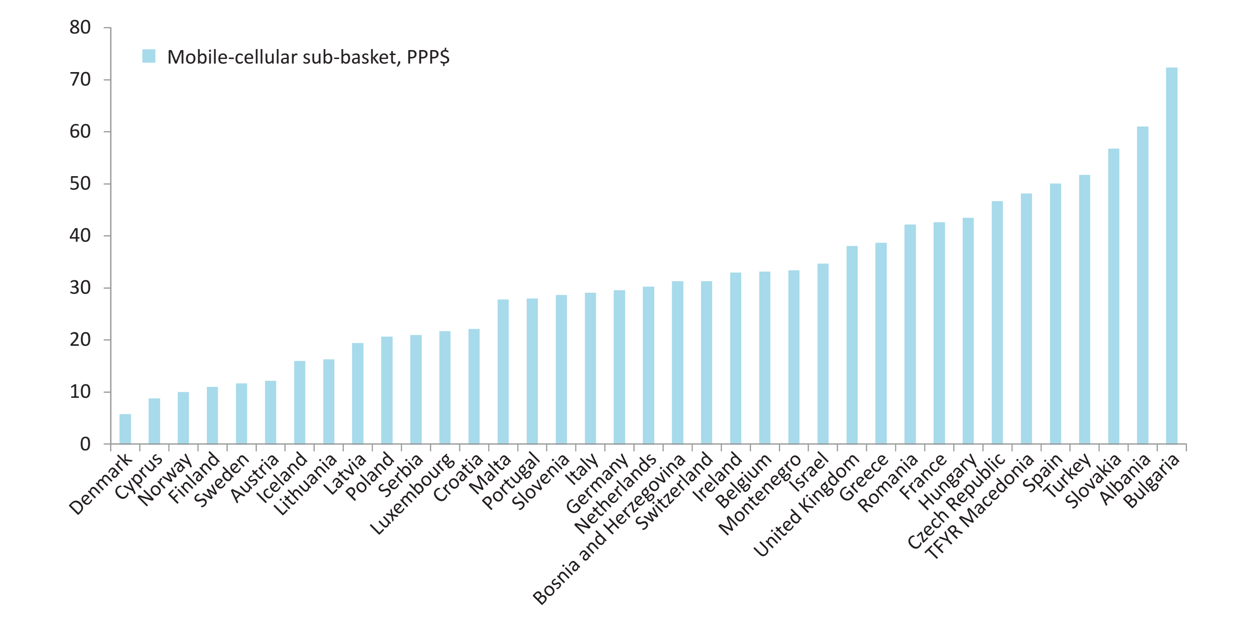
Europe is also quite homogenous in terms of market structure. Telecommunication markets are highly liberalized and competitive (European Commission, 2011c). Only five countries in the region are not affiliated with the European Union, the remainder being either member states or candidate countries. Within the European Union, ICT policies and regulations are being coordinated so as to promote competition and deliver affordable access to ICTs. For example, in 2007, legislation was passed to put a cap on roaming prices and enhance price transparency when travelling within the EU. These so-called "Eurotariffs" have since been extended to data roaming.[80] Further regulatory measures concerning prices include a recommendation passed in 2009 to make call termination rates symmetric and consistent with a cost-oriented approach across the EU by end 2012 (European Commission, 2009a). Mobile number portability has been mandatory in the EU since 2003 (see Box 3.4) (European Commission, 2002).

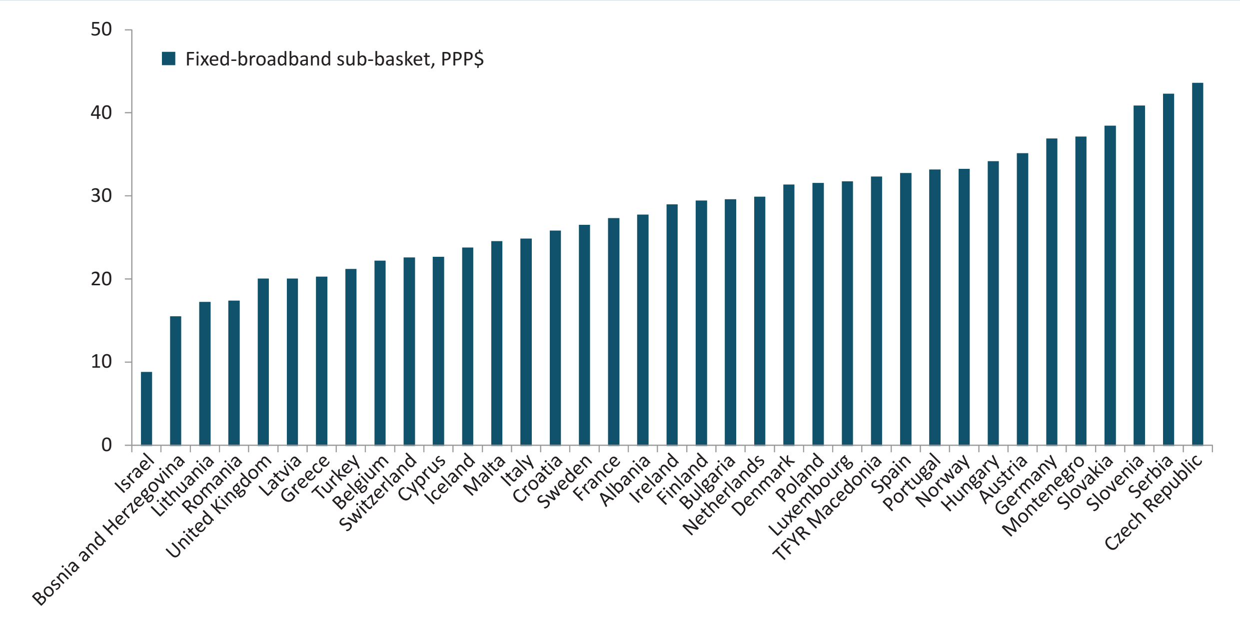
In most countries in Europe, mobile-cellular and fixed-broadband prices in PPP$ terms (Chart 3.16) range from PPP$ 10 to PPP$ 40. Interestingly, the mobile-cellular sub-basket tends to be more expensive than the fixed-

broadband sub-basket. It is important to note that, as in the case of high-income countries in other regions, a low-user basket (as applied here) is likely to overestimate the per-minute cost of mobile-cellular services in Europe since most users subscribe to higher-usage packages that are cheaper on a per-minute basis.

In some countries – Bulgaria, Albania, Slovakia and Turkey – the mobile-cellular sub-basket price exceeds PPP$ 50. In Bulgaria, the price of the mobile-cellular sub-basket represented more than 5 per cent of GNI per capita in 2011, and the country also has the highest mobile-cellular prices in PPP$ terms, at 72.2. The Bulgarian Communications

Chart 3.16: Purchasing power-adjusted ICT prices in Europe, 2011





Source: ITU. PPP$ values are based on World Bank data.
Note: Estonia is not included, since 2011 PPP$ values are not available.

Regulation Commission (CRC) intervened in 2009 and reduced termination rates to EUR 0.0664 per minute, which is still high in regional comparison.[81] Bulgaria's high mobile prices have received quite some attention from the European Commission, and the country's Commission for Protection of Competition (CPC) was looking into a possible pricing cartel; so far, however, the mobile-cellular prices offered by the market leader Mobitel have remained the same for the past few years.[82] Turkey's mobile-cellular prices remain high, at PPP$ 51.6, although they have fallen by 23 per cent from 2010 to 2011, the biggest decrease in Europe. At the same time, the country's 43 per cent tax rate on mobile-cellular services is among the highest in the world and higher than for any other ICT service in the country. Although TFYR Macedonia's mobile-cellular prices have dropped by 18 per cent from 2010 to 2011, following cuts in interconnection fees and the entry of the first MVNO in 2010,[83] they remain relatively high in comparison with other countries in the region, at PPP$ 48.

Relatively affordable prices for fixed-broadband services in Europe reflect a high level of competition and market maturity. Europe has abundant international Internet bandwidth, a high degree of competition in the fixed-broadband market, including through local loop unbundling (mandated in all EU countries) as well as intermodal competition (cable, fibre and mobile-broadband operators). By 2011, the fixed-broadband sub-basket stood at PPP$ 35 or less in over 80 per cent of European countries. Some of the least expensive fixed-broadband services in PPP$-adjusted terms in Europe are available in Israel, Bosnia and Herzegovina, Lithuania and United Kingdom. Bosnia and Herzegovina, where the sub-basket cost PPP$ 15.4, was also the country recording the greatest decrease in prices (of 41 per cent) between 2010 and 2011. Prices lie above PPP$ 40 only in the Czech Republic, Serbia and Slovenia, suggesting that fixed-broadband services in Europe have become largely affordable.

It is also important to note that differences in prices often reflect considerable differences in the quality and speed of services that Europeans receive. For most economies in Europe, minimum broadband speeds are much higher than the required 256 kbit/s, and data allowances generally exceed 1 GB, which effectively limits the comparability of prices. Only six out of the 38 countries in the region offer plans with a 1 GB data allowance, and a clear majority offer only unlimited plans, or plans with much higher download volumes. While Bosnia and Herzegovina and Turkey have a relatively cheap PPP$ fixed-broadband sub-basket based on 1 GB of data, the service offered is different from that offered in Lithuania and Romania, for example, where customers get unlimited downloads and faster speeds for just slightly higher subscriptions charges. Poland is the only country that offered a plan at 256 kbit/s, the minimum criterion as defined by the methodology, with most countries advertising four times as much. Very high advertised speeds at 50 Mbit/s and 20 Mbit/s, respectively, are offered in Romania, one of the few countries where the market leader uses cable and fibre, and the United Kingdom. Both still have low PPP$-adjusted prices for high-speed Internet access. Finally, increases in fixed-broadband prices most often reflect an increase in the amount of data included, or the speed. Serbia's 30 per cent increase in fixed-broadband prices between 2010 and 2011, for instance, came with a sixfold increase in the download speeds advertised by Telekom Serbia.

The IPB results highlight that Europeans have access to relatively inexpensive fixed-broadband services, that they fare well in international comparisons, and that differences in affordability are relatively small. For high-income economies with well-developed markets – like those found in Europe – a finer and more subtle analysis of disparities going beyond basic prices might take into consideration such factors as quality of service and speed. Detailed information on usage patterns, and low-user and high-end user packages, for example, are collected and published by EC (European Commission, 2011d) and OECD.[84]

3.5 Towards a mobile-broadband price basket: Preliminary findings and analysis

Introduction and methodology

Globally, the number of mobile-broadband subscriptions overtook the number of fixed-broadband subscriptions in 2008. In 2011, fixed-broadband penetration stood at 8.5 per cent, while mobile-broadband penetration was almost twice as high, at 16 per cent. In a number of countries,

especially from the developing world, mobile-broadband penetration clearly tops fixed broadband. By the end of 2011, mobile-broadband services were offered commercially in more than 160 countries. Having said that, not all countries have launched 3G services and, if so, only in urban areas, and many commercial mobile-broadband services were only launched in the last few years.

In view of their growth rates and their potential for connecting more and more people to the Internet, the price and affordability of mobile-broadband services is becoming an important issue. The main reason why the current ICT Price Basket includes only fixed-broadband prices is the difficulty of defining a methodology to measure mobile-broadband prices that allows comparisons across countries. Given the relative novelty of the service, mobile-broadband pricing structures are changing quite rapidly, and vary between countries. With this in mind, in the second half of 2011 ITU conducted a pilot mobile-broadband price data-collection exercise, with the aim of understanding the methodological constraints and difficulties involved and of gaining insights into the affordability of mobile-broadband services. The approach adopted took into consideration the ongoing discussions in the ITU Expert Group on Telecommunication/ICT Indicators (EGTI), which has been addressing the issue of measuring mobile-broadband prices since early 2011.

Mobile broadband may refer to a subscription to a USB-modem/dongle, which enables a laptop or other device to connect to the Internet via a mobile-broadband network; or it could equally refer to a subscription to the Internet via a mobile-cellular telephone (handset). Both types of subscription use the same high-speed mobile network; but usage, packages and prices differ in each case. Four possible types of mobile-broadband plans exist: prepaid mobile-broadband for usage on a computer or a handset, and postpaid mobile-broadband for usage on a computer or a handset (see Box 3.5, Figure Box 3.5). In addition, in some (mostly developed) countries operators have started to offer mobile-broadband plans for use on tablet computers. These were not considered in the data-collection exercise, since their availability is still very limited.

Some comparisons need to be made and some rules established before a harmonized mobile-broadband sub-basket can be calculated. In this data-collection exercise, the prices collected were those for prepaid mobile-broadband access using a handset[85] and postpaid mobile-broadband access using a computer.[86] A selection had to be made among the four price sets in order to limit the volume of the dataset for the pilot exercise. It was decided to choose both a handset-based and a computer-based option, because in a number of developing countries, especially in Africa, operators do not (yet) offer mobile-broadband services for handsets. Furthermore, mobile broadband using a computer is more comparable to fixed (wired)-broadband, since data allowances are typically higher than for handset-based mobile-broadband plans. Similarly, it was decided to collect data for both a prepaid and a postpaid option, because postpaid subscriptions are the norm in developed economies, while prepaid is the only payment method low-income users in developing countries can afford and qualify for.

Mobile-broadband price data from 127 countries were collected. When a service was not available or information as advertised on the operator's website(s) was not clear, the country was excluded as a whole or just kept for one service. For the calculation of regional averages, only those 116 countries for which both prepaid handset-based and postpaid computer-based prices were available, were included. Table 3.11 shows the number of countries for which mobile-broadband prices were collected in each region.

Affordability of mobile-broadband services

The results of this price data-collection exercise for prepaid handset-based and postpaid computer-based access were calculated as a percentage of a country's average monthly GNI per capita, in order to analyse the affordability of mobile-broadband services. Based on the methodology applied, the following conclusions regarding the affordability of mobile broadband can be drawn. A more detailed discussion on the constraints of the selected methodology is provided at the end of the section.

Mobile-broadband services are more affordable in developed than in developing countries. While mobile-broadband prices correspond on average to less than 2 per cent of monthly GNI per capita in the developed countries, they correspond

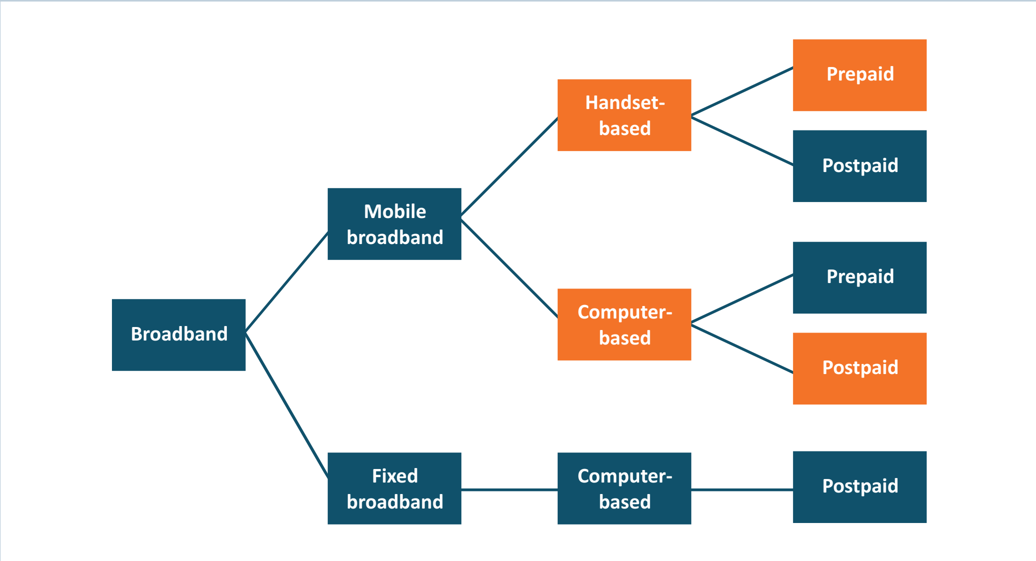
Box 3.5: Collection of mobile-broadband price data

In the second half of 2011, ITU conducted a pilot data-collection exercise to gather information on mobile-broadband prices. Price data were collected directly from operators' websites. Since few countries report which operator has the largest market share in the mobile-broadband market, data were collected from the mobile-cellular operator with the largest market share as measured by the number of mobile-cellular subscriptions. Where the mobile-cellular market leader did not offer mobile-broadband services, a different operator was selected. All prices were converted into USD using the average annual UN operational rate of exchange. To provide insights into the affordability of mobile-broadband services, prices were calculated as a percentage of a country's average monthly GNI per capita, in line with the methodology applied for the ICT Price Basket.[87]

The mobile-broadband basket presented here refers to the price of a monthly subscription for (a minimum of) one Gigabyte (GB). For plans that were limited in terms of data allowance (below one GB), the price per additional byte was added, and for plans that were limited in terms of time (below one month), the price per additional day was added.

Non-recurring charges or charges for end devices were not taken into account. Figure Box 3.5 illustrates the four different options that are offered for mobile broadband. Where available, prepaid prices were collected for handset-based access, and prices for postpaid plans were collected for computer-based access. Where no postpaid computer-based services were available, prepaid computer-based prices were collected instead. Finally, in some countries no handset offers, either prepaid nor postpaid, were available (yet); for such countries, only postpaid (or prepaid) computer-based prices are shown.

Figure Box 3.5: Fixed- and mobile-broadband service options/packages



Source: ITU.
Note: Data were collected for the options in orange.

to more than 30 per cent of monthly GNI per capita in developing countries. Mobile-broadband prices are most affordable in Europe, where subscribers pay around 1 per cent of GNI per capita for both prepaid handset-based and postpaid computer-based services (see Chart 3.17).

While mobile-broadband services are most affordable in high-income countries, a number of lower-middle-income and upper-middle-income countries[88] stand out for their competitive offers.[89] In the Asia-Pacific region, Sri Lanka has prepaid and postpaid offers at prices corresponding to around 3 per cent of GNI per capita, which is comparable with high-income countries in the region. Morocco is a lower-middle-income country with computer-based postpaid mobile-broadband prices below 5 per cent and prepaid handset-based prices of less than 10 per cent of

Table 3.11: Number of countries for which mobile-broadband price data were collected, by region

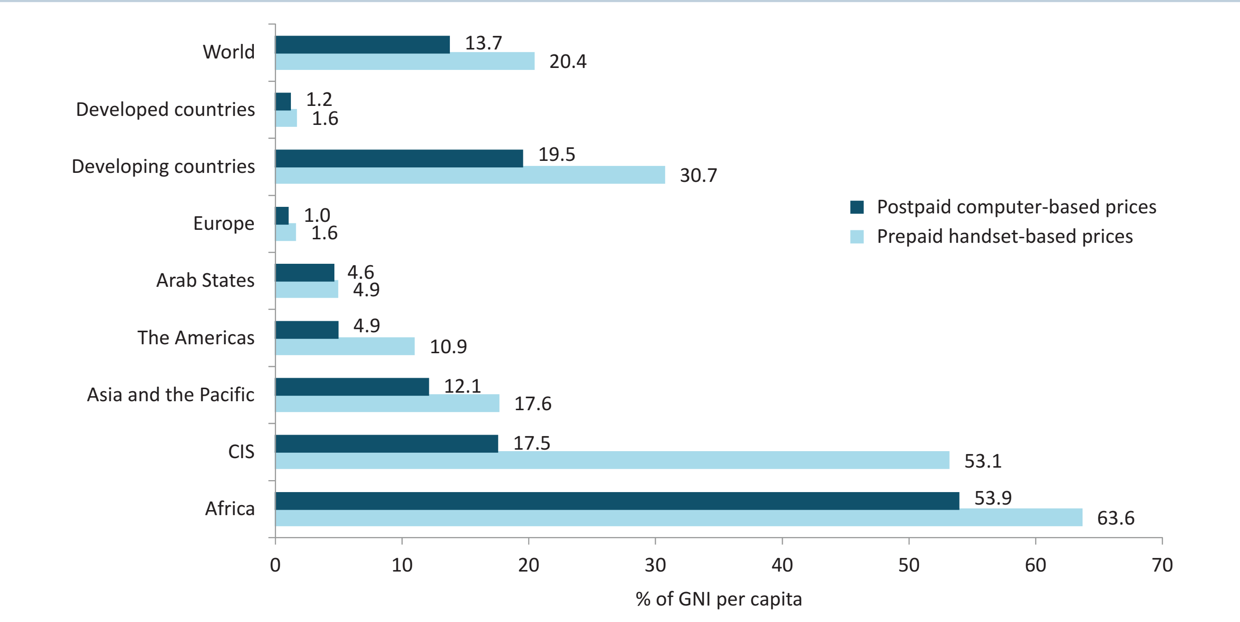
Region	Prepaid handset-based	Postpaid computer-based
Africa	18	23*
The Americas	21	22
Arab States	11	14
Asia and the Pacific	23	22
Europe	35	35
CIS	9	10**
Total	117	126

Source: ITU.
Note: * of which four are prepaid. ** of which one is prepaid.

GNI per capita. In the Americas, prices for prepaid handset-based and postpaid computer-based mobile broadband in upper-middle-income countries such as Costa Rica, Panama and Venezuela are below 3 per cent of GNI per capita. In the CIS region, the lower-middle-income countries Moldova and Ukraine offer relatively affordable prepaid and postpaid mobile-broadband services at prices corresponding to under 5 per cent of GNI per capita.

Africa is the continent with the highest, and the widest range of, mobile-broadband prices. Whereas in the upper-middle-income countries Mauritius, Namibia, Seychelles and South Africa 1 GB of postpaid mobile-broadband services costs 10 per cent or less of GNI per capita, it corresponds to more than 200 per cent of GNI per capita in Zimbabwe and 600 per cent in Liberia, and is thus not affordable for large segments of the population. The low-income and lower-

Chart 3.17: Mobile-broadband prices as a percentage of GNI per capita, 2011, by region and by level of development



Source: ITU.
Note: Simple averages. Kuwait is not included, as GNI per capita was not available. Averages do only include those 116 countries for which both prepaid handset-based and postpaid computer-based prices were available.

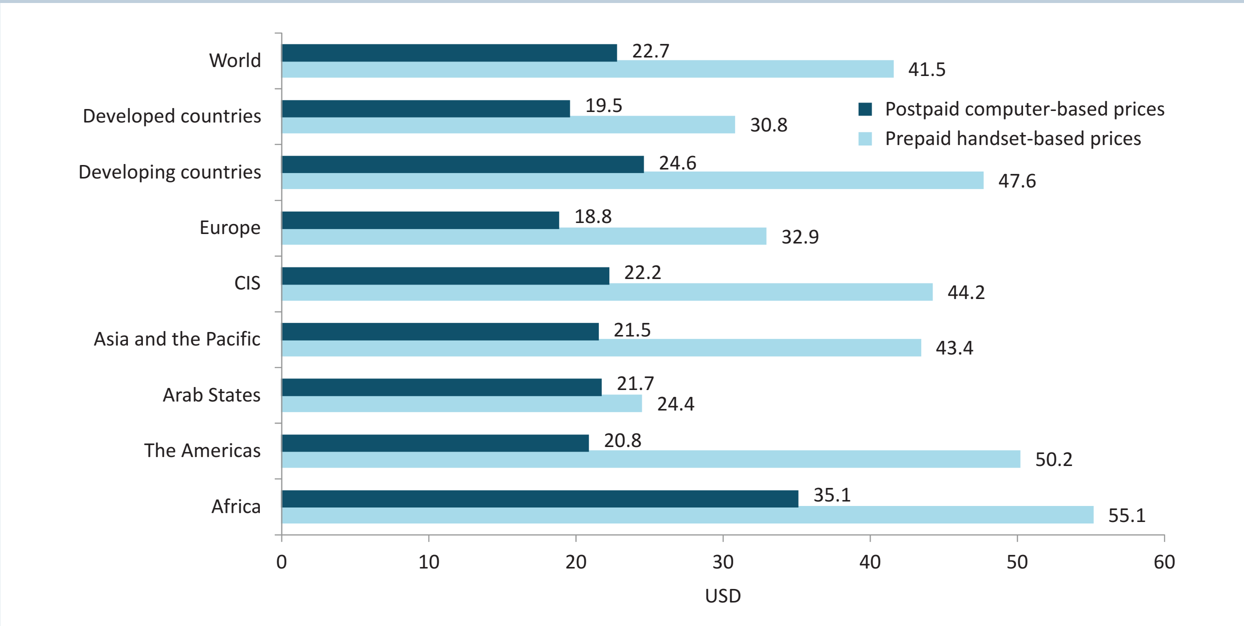
middle-income countries Kenya and Ghana stand out with prices well below the African average for both prepaid and postpaid, although mobile-broadband prices are still high there (14-19 per cent of GNI per capita). A number of African countries have not or have only very recently launched 3G services. Handset-based mobile-broadband is not (yet) available in all countries in the region, and in this case only computer-based access to a mobile-broadband network is possible. In four African countries, the only offers available were for prepaid computer-based access (see Table 3.11).

Comparing prepaid handset-based and postpaid computer-based mobile-broad-band prices

Prepaid handset-based mobile-broadband access is more expensive on average than postpaid computer-based mobile-broadband subscriptions. Looking at the prices of prepaid and postpaid mobile broadband in USD globally, for postpaid computer-based access customers pay USD 23 on average for a minimum of 1 GB of data volume per month, whereas prepaid handset customers are charged USD 42. A volume of 1 GB of prepaid handset-based access is more expensive than 1 GB of computer-based mobile-broadband access in USD in every region of the world (see Chart 3.18). In the Arab States, prepaid handset-based prices are just slightly more expensive (USD 0.70) on average, whereas in Africa prepaid handset-based prices are USD 20 more expensive on average than postpaid computer-based mobile-broadband prices. In all other regions, postpaid computer-based mobile-broadband services cost just half or less of prepaid handset-based offers.

Data allowances tend to be lower for prepaid handset-based access than for postpaid computer-based subscriptions. On average, postpaid computer-based plans offer bigger data allowances than prepaid handset-based packages. Thus, if the former are more expensive, it is often because of the different data allowances included in the package. In Italy and Liechtenstein, for example, the lowest cap for postpaid computer-based mobile-broadband subscriptions is 10 GB and 5 GB, respectively, which makes them more expensive than a 1 GB prepaid package. This, however, is the exception

Chart 3.18: Mobile-broadband prices in USD, 2011, by region and by level of development



Source: ITU.
Note: Simple averages. Kuwait is not included, as GNI per capita was not available. Averages do only include those 116 countries for which both prepaid handset-based and postpaid computer-based prices were available.

and postpaid computer-based plans often provide more volume for the same or even less money.

Comparing mobile-broadband and fixed-broadband prices

Mobile broadband frequently serves as a supplement to fixed high-speed Internet. For many people, however, especially in developing countries and in rural and remote areas, mobile-broadband connections are the only access method. In Europe, too, mobile broadband has its place as a substitute for fixed broadband. In the United Kingdom, 7 per cent of households use mobile broadband as their only Internet connection. A significant proportion of these households belong to a lower socio-economic group, and mobile broadband is favoured by many young people, a phenomenon which Ofcom ascribes to "a combination of affordability and higher levels of 'mobility'" (Ofcom, 2010a). Mobile-broadband subscriptions have registered an average annual growth of over 40 per cent over the last four years, and have overtaken fixed-broadband subscriptions in all regions of the world. Especially where fixed infrastructure is poorly developed, mobile broadband is taking the place of fixed broadband and has the potential to connect many remote and previously unserved areas and populations. Thus, it is important to make a comparison of the affordability of fixed- and mobile-broadband services, which will have a decisive impact on further uptake.

While both fixed- and mobile-broadband services are still very expensive in most regions of the world, in developing countries mobile broadband is less expensive (for low-volume subscribers) than fixed broadband. The fixed-broadband basket is by far the most expensive sub-basket of the IPB. Although decreasing, it is still considerably higher in developing than in developed countries. People in developing countries pay on average around USD 62 for fixed broadband, as against USD 25 in developed countries. Prices for mobile broadband in developed countries are largely comparable with fixed-broadband prices (at USD 31 for prepaid handset-based and USD 19.5 for postpaid computer-based access), while in developing countries, on average, prepaid handset-based mobile broadband costs USD 48 and postpaid computer-based mobile broadband costs USD 25 per month. Both postpaid and prepaid mobile broadband are cheaper on average than fixed broadband in Africa, the Americas and the Arab States. In Asia and the Pacific, prepaid handset-based mobile broadband is more expensive than fixed broadband, while postpaid computer-based mobile broadband is cheaper on average. The CIS region is the exception, insofar as fixed broadband is less expensive on average than mobile broadband.[90]

At the country level, on the basis of the price for 1 GB of volume expressed in USD, fixed-broadband services are cheaper than mobile broadband in 34 out of 121 countries.[91] In no fewer than 47 countries, however, mobile broadband, both prepaid handset-based and postpaid computer-based, is cheaper than fixed broadband. In 28 countries, prepaid handset-based services are more expensive than fixed broadband, but postpaid computer-based mobile-broadband access is cheaper.

Mobile-broadband prices as collected are comparable to the fixed-broadband sub-basket of the IPB to some degree, insofar as both include at least 1 GB of download allowance over a period of one month (see Table 3.12). Data allowances, speeds and subscription type (prepaid or postpaid) differ, however, as described below.

First, the majority of fixed-broadband packages are unlimited (in 105 out 162 countries), or usually include data allowances well above 1 GB. Only a very small number of countries offer unlimited postpaid computer-based mobile-broadband services and, if so, these offers often come with a catch. Verizon applies its fair-usage policy and caps the speed of its top 5 per cent data users in the United States.[92] Maroc Telecom throttles[93] the speed of its postpaid customers to 512 kbit/s after 5 GB and down to 64 kbit/s after 20 GB of usage.[94]

Secondly, real mobile-broadband speeds depend on several factors. They are thus more difficult to predict, mostly lower than advertised and generally slower than fixed broadband. HSDPA/HSUPA with theoretical maximum speeds of 7.2 Mbit/s is used in a majority of countries (see Table 3.13). However, actual mobile-broadband speeds depend on the geographic location of the user. Speed, network coverage availability and quality are determined by distance (from the base station), location (inside a building or outdoors) and movement (stationary or in motion). The number of people accessing a network in the same location is also a very important factor influencing speeds. Many of these factors

Table 3.12: Comparison of fixed-broadband and postpaid computer-based mobile-broadband plans in selected countries, 2011

Country	Operator		Data allowance (GB)	Plan price (USD)	Speed (Mbit/s)
Finland	Elisa	Mobile	Unlimited	13 (1 Mbit/s), 18.3 (15 Mbit/s)	1 or 15
		Fixed		35.4	10
Iceland	Siminn	Mobile	1	8.9	5
		Fixed		26.8	12
Netherlands	KPN	Mobile	2	39.4	7.2
		Fixed	Unlimited	32.9	8
El Salvador	Claro	Mobile	1	15.0	1.5
		Fixed	Unlimited	15.8	1
Panama	C&W	Mobile	1	9.7	2
		Fixed	Unlimited	14.6	2
Peru	Movistar	Mobile	1	20.9	3
		Fixed	Unlimited	29.6	0.51
Gambia	Gamtel	Mobile	Unlimited	92.5	2.1
		Fixed		280.3	0.26
Mauritania	Mauritel	Mobile	Unlimited	54.3	0.512
		Fixed		23.5	

Source: ITU.

Table 3.13: Broadband technologies and maximum speeds

Broadband technology	Theoretical/maximum speed in Mbit/s	Number of countries included in data collection
HSDPA/HSUPA	7.2	88
HSPA+	14.4	12
EV-DO	3.1	5
WCDMA	0.384	2

Source: ITU.
Note: Fourteen countries use a combination of two technologies. Technologies are unknown for five countries.

are outside the control of individual users, and are difficult for service providers to predetermine (Ofcom 2011c). This is not the case with fixed broadband, which is much less dependent on external factors, with the result that fixed-broadband speeds are easier to predict and guarantee. A study by the British regulator Ofcom found that in the United Kingdom "average speed, latency and webpage download times for mobile broadband perform at levels lower than those typically delivered by fixed-broadband services."[95] Whereas an average speed of 1.5 Mbit/s has been determined for mobile broadband, fixed broadband attains much higher speeds of 6.2 Mbit/s in the United Kingdom. Therefore, advertised mobile-broadband speeds are theoretical indications, and maximum speeds are seldom reached. Legislation is being proposed to better inform customers, such as for example in Finland where since 2011 the country's regulator obliges operators to inform customers about the true speed range of mobile-broadband services.[96]

Finally, the fixed-broadband sub-basket is based on postpaid prices only, whereas for mobile broadband both prepaid and postpaid prices have been collected. Longer commitments are reasonable for fixed-broadband services, since access to fixed broadband requires the rental of a fixed

line for DSL. Mobile-broadband offers, on the other hand, are more readily available in areas that are covered by a 3G network, since prepaid subscribers require nothing more than a handset or a laptop with a dongle to access the Internet. Mobile broadband thus offers greater mobility, as subscribers can access the Internet from anywhere (within 3G coverage). Fixed-broadband (postpaid) prices are more comparable to postpaid mobile-broadband than prepaid mobile-broadband prices, because postpaid prices tend to be lower than prepaid prices: when operators can count on long-term consumption and hence revenue, they will often offer lower prices to customers.[97]

A study by Ofcom concludes that "because mobile broadband does not require rental of a fixed line, it represents a lower-cost way for some households to get online, although (…) the typically slower speeds provided and the lower usage limits do not make it directly comparable to fixed-line broadband" (Ofcom, 2010a). Furthermore, for high-volume users, and businesses especially, on account of its limited data allowances and slower actual speeds mobile broadband cannot be a direct substitute for fixed broadband.

Mobile broadband, when affordable, can help connect people to the Internet in lower-income, developing countries. Where fixed-broadband infrastructure is poorly developed, rising mobile-broadband penetration rates bear witness to the importance of mobile broadband in connecting people to the Internet. Given that affordability and uptake are strongly linked, however, mobile broadband can only help to bring more and more people online where it is affordable. A good example is Namibia, an African upper-middle-income country which has mobile-broadband prices, for both prepaid and postpaid, well below the regional average at around 10 per cent of GNI per capita, and a considerably higher number of mobile-broadband than fixed-broadband subscriptions. Namibian mobile-broadband subscribers, both prepaid and postpaid, pay around a third of what fixed-broadband subscribers pay for a basket based on 1 GB. The majority (79 per cent) of mobile-broadband subscriptions in the country are prepaid,[98] and 1 GB through prepaid handset-based access is only slightly more expensive than the same amount through postpaid computer-based access. Another example is Indonesia, which stands out as an Asia-Pacific lower-middle-income country with an above average mobile-broadband penetration rate for the region of around 22 per cent. Mobile-broadband prices remain below the regional average, and postpaid computer-based access is also less expensive for low-volume users than fixed broadband.

Constraints of the mobile-broadband price basket

While the analysis of mobile-broadband prices provides important insights into the affordability of the service, the data-collection exercise revealed the methodological constraints and the difficulties of collecting mobile-broadband prices. In a number of cases, applying the criteria adopted for the exercise – necessary for international comparisons – misrepresent prices and results in tariffs that are higher than what customers would actually pay. This is particularly true for prepaid offers which, as collected in this exercise, often do not reflect current usage patterns of mobile Internet users around the world.

In the case of prepaid mobile broadband, customers are not charged per byte of usage based on what they actually consume/download, but rather have to pay in advance for a given usage volume or time. Where the volume is less than 1 GB or the period of validity is shorter than 30 days, (multiple) recharges will have to be added in order to fit the criteria as defined for this data-collection exercise. Two main pricing schemes have been identified: a) *volume-limited* and b) *time-limited* pricing.

a) Volume-limited prepaid packages include less than 1 GB of download allowance with a relatively long period of validity. Prepaid handset-based access that is volume-restricted does not seem to be intended for extensive use, but rather occasional, limited usage. Thus, calculating volume-limited prepaid packages on the basis of 1 GB of volume per month makes them appear extremely expensive. Volume-limited offers are common in Europe.[99] In Greece, for example, customers would have to purchase 17 "monthly passes" of 60 MB for USD 3.90 each to reach 1 GB, since operators do not offer higher-volume monthly packages. Another example is Chile, where, to reach 1 GB per month, customers would have to buy 14 packs of 75 MB (with a validity of 30 days each), which makes prepaid handset prices very high for this volume. Some

operators throttle speeds before 1 GB of download volume has been reached. T-Mobile Germany's prepaid data plans are limited to 200 MB, after which bandwidth is reduced to 64 kbit/s. Thus, in accordance with the criteria adopted for this data-collection exercise, to obtain 1 GB at broadband speeds customers would have to purchase five 200 MB packages. Vivo Brazil throttles speeds to 32 kbit/s after prepaid customers have downloaded 25 MB of data; to maintain broadband speeds for a usage profile of 1 GB per month, customers would have to recharge 40 times, which makes this offer very expensive.

b) Time-limited prepaid packages are only available for a duration of less than 30 days. These packages can also be volume-limited, but in this case users are more likely to be restricted by time than by volume. In Singapore, for example, prepaid customers purchase a seven-day pack during which time they can use 1 GB. In Nicaragua, customers can use 1 GB within 15 days. To reach a download allowance of 1 GB over one month, packages will have to be multiplied, making prices very high (and resulting in volume allowances that are effectively higher than the 1 GB cap defined for the data-collection exercise). Time-limited offers seem to be targeting customers who want to access the Internet on an exceptional, rather than regular, basis, or for particular periods of time.

Pay-as-you-go pricing is not based on the consumption of a certain amount of volume or over a certain amount of time.[100] Customers are instead charged per byte of downloaded volume.[101] This is often a lot more expensive, such as in Fiji, where handset customers would have to pay USD 523.81 to reach 1 GB (as compared with postpaid customers who pay only USD 40.84 for 1 GB). In Botswana, pay-as-you-go prepaid handset-based customers are also charged per MB, at USD 0.22, such that to reach 1 GB customers would pay USD 223.6.[102]

In some cases, a restricted plan perfectly fits the ITU criteria and thus comes out as relatively cheap. In both Malta and Italy, prepaid cards with a 250 MB data allowance over a time period of seven days are available. Multiplied by four, these packages fit the 1 GB per month criterion defined for the data-collection exercise perfectly, and are thus among the cheapest offers in Europe. Where operators have few or no pricing schemes which match the criteria, however, prepaid handset-based mobile-broadband prices appear very high. The same holds true for postpaid computer-based mobile-broadband prices, which will be comparably higher when they include very large monthly data allowances, as is the case in Italy, Liechtenstein and Lao PDR. Ultimately, the objective is to define pricing schemes and usage patterns that best reflect reality, which is a challenging proposition for any global comparison.

Other main challenges for data collection and comparison are the lack of clear labeling and restrictions often found in the small print. Some operators apply fair-usage policies without specifying the terms (e.g. the data allowances included in an offer). In a number of countries, prepaid offers are only available to existing customers or in combination with/as an add-on to voice and sms.[103] In Mauritania, prepaid handset-based access can only be purchased with voice and sms and is based on hours of consumption (two hours within five days), so price data for prepaid handset-based mobile broadband could not be collected. In other instances, postpaid customers have to commit for a period of over one year.

The way forward

While mobile-broadband services are less expensive than fixed-broadband services in a majority of countries, they still remain unaffordable for a large segment of the world's population. For mobile broadband to replicate the mobile-cellular miracle and bring more people online, 3G coverage has to be extended and prices have to go down.

The 2011 ITU mobile-broadband price data-collection exercise has confirmed the challenges which establishing a mobile-broadband price basket entails and highlighted the difficulties in measuring mobile-broadband prices that can be compared across countries. The following lessons learned and conclusions drawn from this pilot data-collection exercise should be considered for the development of a future mobile-broadband basket:

- There are important differences between handset-based and computer-based usage and prices. A mobile-broadband price basket should thus consider all four options offered by operators (see Figure Box 3.5) in order to allow comparisons

between the different services. This will also increase the number of countries that can be included in the mobile-broadband price basket, since not all options are available in every country.

- While the results reveal that postpaid computer-based offers are cheaper than prepaid handset-based offers, it remains unclear whether postpaid offers are more affordable than prepaid offers in general, irrespective of the end device used. Collecting prepaid and postpaid prices for both handset-based and computer-based usage will enable conclusions to be drawn in this regard.

- It might be necessary to define different sets of criteria and collect data on different plans (in terms of volume) according to whether the access is handset-based or computer-based. The data-collection exercise revealed that prepaid handset-based data allowances were almost invariably smaller than the 1 GB minimum for which the data were collected, and packages often had to be multiplied, making prices very high. Computer-based plans, on the other hand, came with much higher data allowances.

- In addition to defining different sets of criteria for handset-based and computer-based mobile-broadband usage, the collection of different price data sets for low-usage and high-usage customers should also be considered. Mobile-broadband prices, as confirmed by this price data-collection exercise, vary considerably between countries, and many different plans exist targeting different types of customers.

- Future discussions should consider special plans for mobile-broadband access using other mobile devices, such as tablets, which are expected to increase in all countries, including in the developing world.

The outcome of this research will feed into the discussions on mobile-broadband prices under way in the ITU Expert Group on Telecommunication/ICT Indicators (EGTI), which will continue its work throughout 2012.[104] Work on developing a methodology for a wireless-broadband basket has also been ongoing in the OECD Working Party on Communication Infrastructures and Services Policy (CISP). The results of these various discussions will lead to an improved methodology for a future mobile-broadband price basket.

Table 3.14: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, Europe

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Albania	Prepaid handset-based	14.6	4.4
	Postpaid computer-based	16.6	5.0
Austria	Prepaid handset-based	26.3	0.7
	Postpaid computer-based	17.8	0.5
Belgium	Prepaid handset-based	65.7	1.7
	Postpaid computer-based	26.3	0.7
Bulgaria	Prepaid handset-based	16.7	3.2
	Postpaid computer-based	10.7	2.0
Croatia	Prepaid handset-based	13.7	1.2
	Postpaid computer-based	13.7	1.2
Cyprus	Prepaid handset-based	65.7	2.7
	Postpaid computer-based	21.0	0.9
Czech Republic	Prepaid handset-based	28.3	1.9
	Postpaid computer-based	27.1	1.8
Denmark	Prepaid handset-based	8.6	0.2
	Postpaid computer-based	17.5	0.4
Estonia	Prepaid handset-based	10.4	0.9
	Postpaid computer-based	7.9	0.7
Finland	Prepaid handset-based	26.0	0.7
	Postpaid computer-based	13.0	0.3
France	Prepaid handset-based	31.6	0.9
	Postpaid computer-based	25.0	0.7
Germany	Prepaid handset-based	13.1	0.4
	Postpaid computer-based	39.4	1.1
Greece	Prepaid handset-based	67.1	3.0
	Postpaid computer-based	19.7	0.9
Hungary	Prepaid handset-based	19.0	1.8
	Postpaid computer-based	9.1	0.8
Iceland	Prepaid handset-based	40.8	1.5
	Postpaid computer-based	8.9	0.3
Ireland	Prepaid handset-based	26.3	0.8
	Postpaid computer-based	13.1	0.4
Italy	Prepaid handset-based	13.1	0.4
	Postpaid computer-based	25.0	0.9
Latvia	Prepaid handset-based	9.3	1.0
	Postpaid computer-based	9.3	1.0
Liechtenstein	Prepaid handset-based	7.9	0.1
	Postpaid computer-based	30.7	0.3
Lithuania	Prepaid handset-based	7.2	0.8
	Postpaid computer-based	4.6	0.5
Luxembourg	Prepaid handset-based	46.0	0.7
	Postpaid computer-based	19.6	0.3
Malta	Prepaid handset-based	15.8	1.0
	Postpaid computer-based	19.7	1.2
Montenegro	Prepaid handset-based	16.4	2.9
	Postpaid computer-based	19.7	2.9
Netherlands	Prepaid handset-based	131.5	3.2
	Postpaid computer-based	39.4	1.0
Norway	Prepaid handset-based	32.5	0.5
	Postpaid computer-based	16.2	0.2
Poland	Prepaid handset-based	9.8	0.9
	Postpaid computer-based	11.5	1.1
Portugal	Prepaid handset-based	41.0	2.2
	Postpaid computer-based	13.0	0.7
Romania	Prepaid handset-based	5.7	0.9
	Postpaid computer-based	2.5	0.4
Serbia	Prepaid handset-based	9.1	1.9
	Postpaid computer-based	5.2	1.1
Slovakia	Prepaid handset-based	9.1	0.7
	Postpaid computer-based	8.6	0.6
Slovenia	Prepaid handset-based	78.9	4.0
	Postpaid computer-based	25.0	1.3
Spain	Prepaid handset-based	156.5	5.9
	Postpaid computer-based	38.8	1.5
Sweden	Prepaid handset-based	34.5	0.8
	Postpaid computer-based	13.7	0.3
Switzerland	Prepaid handset-based	37.5	0.6
	Postpaid computer-based	56.7	1.0
United Kingdom	Prepaid handset-based	15.4	0.5
	Postpaid computer-based	15.7	0.5

Source: ITU.
Note N/A – Not available.

Table 3.15: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, the Americas

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Argentina	Prepaid handset-based	24.4	3.4
	Postpaid computer-based	25.3	3.5
Bolivia	Prepaid handset-based	25.0	16.6
	Postpaid computer-based	14.1	9.4
Brazil	Prepaid handset-based	281.0	35.9
	Postpaid computer-based	51.0	6.5
Canada	Prepaid handset-based	54.8	1.5
	Postpaid computer-based	40.5	1.1
Chile	Prepaid handset-based	82.6	9.8
	Postpaid computer-based	31.4	3.7
Colombia	Prepaid handset-based	131.5	28.6
	Postpaid computer-based	16.8	3.7
Costa Rica	Prepaid handset-based	17.4	3.1
	Postpaid computer-based	10.4	1.8
Dominican Republic	Prepaid handset-based	44.8	10.7
	Postpaid computer-based	20.1	4.8
Ecuador	Prepaid handset-based	56.0	17.5
	Postpaid computer-based	21.3	6.6
El Salvador	Prepaid handset-based	16.0	5.7
	Postpaid computer-based	15.0	5.3
Guatemala	Prepaid handset-based	18.0	7.9
	Postpaid computer-based	18.0	7.9
Honduras	Prepaid handset-based	26.4	17.0
	Postpaid computer-based	15.0	9.6
Jamaica	Prepaid handset-based	40.2	10.1
	Postpaid computer-based	23.0	5.7
Mexico	Prepaid handset-based	39.5	5.3
	Postpaid computer-based	19.7	2.7
Nicaragua	Prepaid handset-based	18.4	19.9
	Postpaid computer-based	13.8	14.9
Panama	Prepaid handset-based	14.7	2.5
	Postpaid computer-based	9.8	1.7
Paraguay	Prepaid handset-based	42.2	18.7
	Postpaid computer-based	12.7	5.6
Peru	Prepaid handset-based	37.2	9.5
	Postpaid computer-based	20.9	5.3
Trinidad & Tobago	Prepaid handset-based	N/A	
	Postpaid computer-based	54.6	4.3
United States	Prepaid handset-based	32.6	0.8
	Postpaid computer-based	32.6	0.8
Uruguay	Prepaid handset-based	14.9	1.7
	Postpaid computer-based	9.8	1.1
Venezuela	Prepaid handset-based	35.6	3.7
	Postpaid computer-based	16.4	1.7

Source: ITU.
Note N/A – Not available.

Table 3.16: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, Asia and the Pacific

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Australia	Prepaid handset-based	36.0	1.0
	Postpaid computer-based	36.9	1.0
Bangladesh	Prepaid handset-based	13.3	22.8
	Postpaid computer-based	10.0	17.1
Bhutan	Prepaid handset-based	65.6	42.1
	Postpaid computer-based	8.7	5.6
Brunei Darussalam	Prepaid handset-based	52.0	2.0
	Postpaid computer-based	22.3	0.8
Cambodia	Prepaid handset-based	5.0	8.0
	Postpaid computer-based	50.0	80.0
China	Prepaid handset-based	47.2	13.3
	Postpaid computer-based	N/A	
Fiji	Prepaid handset-based	523.8	173.2
	Postpaid computer-based	21.4	7.1
Hong Kong, China	Prepaid handset-based	21.8	0.8
	Postpaid computer-based	42.6	1.6
India	Prepaid handset-based	9.8	8.9
	Postpaid computer-based	9.8	8.9
Indonesia	Prepaid handset-based	11.1	5.3
	Postpaid computer-based	8.3	4.0
Korea (Rep.)	Prepaid handset-based	22.6	1.4
	Postpaid computer-based	21.2	1.3
Lao P.D.R.	Prepaid handset-based	9.7	11.1
	Postpaid computer-based	24.3	27.8
Macao, China	Prepaid handset-based	12.5	0.4
	Postpaid computer-based	37.3	1.3
Malaysia	Prepaid handset-based	15.5	2.4
	Postpaid computer-based	14.9	2.3
Maldives	Prepaid handset-based	12.3	2.6
	Postpaid computer-based	19.3	4.0
Mongolia	Prepaid handset-based	10.4	6.9
	Postpaid computer-based	8.9	5.9
Nepal	Prepaid handset-based	25.6	69.8
	Postpaid computer-based	25.6	69.8
New Zealand	Prepaid handset-based	43.3	1.8
	Postpaid computer-based	36.1	1.5
Philippines	Prepaid handset-based	16.6	9.7
	Postpaid computer-based	16.6	9.7
Singapore	Prepaid handset-based	20.8	0.6
	Postpaid computer-based	22.2	0.7
Sri Lanka	Prepaid handset-based	4.8	2.6
	Postpaid computer-based	5.3	2.9
Thailand	Prepaid handset-based	11.8	3.4
	Postpaid computer-based	27.0	7.8
Viet Nam	Prepaid handset-based	10.5	10.8
	Postpaid computer-based	4.2	4.3

Source: ITU.
Note N/A – Not available.

Table 3.17: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, Africa

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Angola	Prepaid handset-based	196.1	59.7
	Postpaid computer-based	49.0	14.9
Botswana	Prepaid handset-based	223.6	39.5
	Postpaid computer-based	54.9	9.7
Ethiopia	Prepaid handset-based	31.8	97.8
	Postpaid computer-based	20.7	63.8
Gambia	Prepaid handset-based	N/A	
	Postpaid computer-based	92.5	246.6
Ghana	Prepaid handset-based	14.0	13.7
	Postpaid computer-based	14.0	13.7
Kenya	Prepaid handset-based	12.6	19.2
	Postpaid computer-based	12.6	19.2
Lesotho	Prepaid handset-based	68.9	79.5
	Postpaid computer-based	49.3	56.9
Liberia	Prepaid handset-based	N/A	
	Postpaid computer-based	100.0	600.0
Madagascar	Prepaid handset-based	47.5	132.6
	Postpaid computer-based	23.8	66.3
Malawi	Prepaid handset-based	26.6	96.6
	Postpaid computer-based	19.9	72.5
Mali	Prepaid handset-based	N/A	
	Postpaid computer-based	19.8	39.7
Mauritius	Prepaid handset-based	16.4	2.5
	Postpaid computer-based	16.4	2.5
Mozambique	Prepaid handset-based	29.2	79.7
	Postpaid computer-based	29.2	79.7
Namibia	Prepaid handset-based	39.4	10.5
	Postpaid computer-based	37.9	10.1
Nigeria	Prepaid handset-based	N/A	
	Postpaid computer-based	53.1	54.0
Rwanda	Prepaid handset-based	29.3	67.5
	Postpaid computer-based	34.4	79.5
Senegal	Prepaid handset-based	50.1	55.2
	Postpaid computer-based		
Seychelles	Prepaid handset-based	N/A	
	Postpaid computer-based	38.8	4.8
South Africa	Prepaid handset-based	38.4	7.6
	Postpaid computer-based	34.3	6.8
Sudan	Prepaid handset-based	11.5	10.9
	Postpaid computer-based	20.9	19.8
Tanzania	Prepaid handset-based	27.8	62.9
	Postpaid computer-based	48.6	110.1
Uganda	Prepaid handset-based	23.0	55.3
	Postpaid computer-based	18.5	44.4
Zambia	Prepaid handset-based	27.3	30.7
	Postpaid computer-based	27.3	30.7
Zimbabwe	Prepaid handset-based	90.0	234.8
	Postpaid computer-based	90.0	234.8

Source: ITU.
Note N/A – Not available.

Table 3.18: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, CIS

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Azerbaijan	Prepaid handset-based	23.7	5.3
	Postpaid computer-based	23.7	5.3
Belarus	Prepaid handset-based	9.4	1.9
	Postpaid computer-based	10.0	2.0
Georgia	Prepaid handset-based	N/A	
	Postpaid computer-based	8.4	3.8
Kazakhstan	Prepaid handset-based	10.2	1.6
	Postpaid computer-based	30.7	4.8
Kyrgyzstan	Prepaid handset-based	43.9	62.6
	Postpaid computer-based	43.9	62.6
Moldova	Prepaid handset-based	6.5	4.3
	Postpaid computer-based	6.5	4.3
Russian Federation	Prepaid handset-based	16.5	2.0
	Postpaid computer-based	13.2	1.6
Tajikistan	Prepaid handset-based	240.0	360.0
	Postpaid computer-based	24.3	36.5
Ukraine	Prepaid handset-based	7.6	3.0
	Postpaid computer-based	7.6	3.0
Uzbekistan	Prepaid handset-based	40.0	37.5
	Postpaid computer-based	40.0	37.5

Source: ITU.
Note N/A – Not available.

Table 3.19: Mobile-broadband prices in USD and as a percentage of GNI per capita, 2011, Arab States

Country	Type of plan	Mobile-broadband basket in USD, 2011	Mobile-broadband basket as % of GNI per capita, 2011
Bahrain	Prepaid handset-based	26.6	1.3
	Postpaid computer-based	26.6	1.3
Egypt	Prepaid handset-based	21.4	10.6
	Postpaid computer-based	8.9	4.4
Jordan	Prepaid handset-based	9.8	2.7
	Postpaid computer-based	13.9	3.8
Kuwait	Prepaid handset-based	17.6	N/A
	Postpaid computer-based	24.6	N/A
Libya	Prepaid handset-based	N/A	
	Postpaid computer-based	11.8	1.2
Mauritania	Prepaid handset-based	N/A	
	Postpaid computer-based	54.3	63.3
Morocco	Prepaid handset-based	23.7	10.0
	Postpaid computer-based	11.7	4.9
Oman	Prepaid handset-based	38.8	2.5
	Postpaid computer-based	12.9	0.8
Qatar	Prepaid handset-based	27.4	0.5
	Postpaid computer-based	27.4	0.5
Saudi Arabia	Prepaid handset-based	26.6	2.0
	Postpaid computer-based	26.3	2.0
Syrian Arab Rep.	Prepaid handset-based	N/A	
	Postpaid computer-based	32.4	14.1
Tunisia	Prepaid handset-based	25.9	7.5
	Postpaid computer-based	25.9	7.5
United Arab Emirates	Prepaid handset-based	39.5	1.1
	Postpaid computer-based	39.5	1.1

Source: ITU.
Note N/A – Not available.

Endnotes

1 The link between the IDI and the IPB (i.e. ICT prices and uptake) was also highlighted in ITU (2011b), Chapter 3, p. 61.

2 Fixed-broadband, as per the ITU Handbook for the Collection of Administrative Data on Telecommunications/ICT is defined as subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s, see: ITU (2011a).

3 In the Central African Republic, the number of fixed-telephone subscriptions has decreased to as few as 2 340 (resulting in a penetration rate of 0.05%), and penetration rates are also very low in such countries as Rep. of the Congo (0.24%), Liberia (0.08%), and Tanzania (0.35%). In Nauru, fixed-telephone services were discontinued in 2010.

4 While the ICT Price Basket is a useful tool to assess the effects of different policies, it is important to bear in mind that not all regulatory changes will have an immediate impact on prices. Certain policies may take some time before they bring about a concrete change in prices. Others, such as the revision of interconnection charges, may have a more immediate effect.

5 World Bank, current USD, Atlas method.

6 The ITU ICT Price Basket Questionnaire has been sent to country statistical contacts once a year, since 2009. Before that, prices were collected as part of the regular (long) ITU World Telecommunication/ICT Indicators questionnaire.

7 For this, the average annual UN operational rate of exchange is used.

8 The mobile-cellular sub-basket refers to a 30-call basket, which is the entry-level basket of the 2009 OECD methodology, but with the following differences: the 2009 OECD methodology is based on the prices of the two largest mobile operators. The ITU mobile-cellular sub-basket uses (only) the largest mobile operator's prices. Additionally, the ITU mobile-cellular sub-basket does not take into account calls to voicemail (which in the OECD basket represent 4 per cent of all calls). For more information, refer to Annex 2.

9 For example, if country A and country B have the same price in USD for any given ICT service, but in country A prices of other products are in general cheaper (in USD), then applying PPP exchange rates to the ICT service price in country A will make this service more expensive. That is so because, compared to country B, in country A the same amount of USD (exchanged into national currency at market exchange rates) can buy more products or services. Therefore, the ICT service in country A is more expensive in terms of what could be bought with that amount in each country. The International Comparison Program (ICP) is the major global initiative to produce internationally comparable price levels. It is overseen by a Global Office housed in the World Bank and is implemented through the national statistical offices of 107 countries. Together with the OECD/Eurostat PPP data, it provides a set of 150 benchmark countries and PPP data for all countries in the ICT Price Basket, except for Cuba, Estonia (which changed its currency to EUR on 1 January, 2011) and Zimbabwe. For more information on PPP methodology and data, see http://go.worldbank.org/UI22NH9ME0.

10 The World Bank's Atlas method is used for the Bank's official estimates of the size of economies in terms of GNI converted to current USD. GNI takes into account all production in the domestic economy (i.e. GDP) plus the net flows of factor income (such as rents, profits and labour income) from abroad. The Atlas method smooths exchange-rate fluctuations by using a three-year moving average, price-adjusted conversion factor. See: http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20399244~menuPK:1504474~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html.

11 Operators with large market shares, for example, may tend to offer very low on-net prices (encouraging customers to remain committed by offering cheaper calls to the majority of its other customers) but much higher off-net prices, whereas new market entrants may (initially) offer much cheaper prices to increase their market share. See also Box 3.1 in ITU (2011b).

12 See http://www.telecompaper.com/news/free-mobile-launches-service.

13 See http://www.telecompaper.com/news/bouygues-telecom-cuts-price-of-mid-range-mobile-services.

14 See http://www.rethink-wireless.com/2012/03/09/free-mobile-cost-french-rivals-28-profits.htm.

15 See http://www.arcep.fr/index.php?id=8571&tx_gsactualite_pi1[uid]=1485&tx_gsactualite_pi1[backID]=1&cHash=4ce87680cd.

16 See http://www.lefigaro.fr/societes/2012/03/02/20005-20120302ARTFIG00597-le-reseau-free-mobile-fortement-perturbe.php. See also: http://www.arcep.fr/index.php?id=8571&tx_gsactualite_pi1[uid]=1482&tx_gsactualite_pi1[backID]=1&cHash=526fec2e34.

17 See, for example: http://www.fcc.gov/blog/new-fcc-website-help-consumers-beat-%E2%80%98bill-shock%E2%80%99 and also ITU (2011b), p. 89.

18 See http://www.tra.org.bh/en/pdf/GCCRoamingDecisionPressRelease_en.pdf.

19 See http://www.wired.com/gadgetlab/2011/10/fcc-ctia-bill-shock-guidelines/.

20 See for example regulation in France on mobile phone contracts: http://www.telegeography.com/products/commsupdate/articles/2010/12/01/arcep-calls-for-shorter-fairer-mobile-contracts/.

21 In Japan and Republic of Korea, the number of prepaid subscriptions represents 1 and 2 per cent of the total number of mobile-cellular subscriptions, respectively.

22 For concrete examples of exceptions and concrete country examples, please refer directly to the sub-basket sections.

23 In relative terms. In absolute terms, the difference is smaller for the fixed-telephone sub-basket.

24 It should be noted that the individual sub-baskets are not capped at 100 per cent (they are only capped for the calculation of the IPB), and so the value changes in countries with very high fixed-broadband prices are reflected in the percentage change. The fixed-broadband sub-basket is the only sub-basket where values exceed 100 (i.e. when the price of the fixed-broadband sub-basket is higher than the average monthly GNI per capita in a country).

25 The Broadband Commission for Digital Development was established in 2010 by ITU and UNESCO in response to UN Secretary-General Ban Ki-Moon's call to step up UN efforts to meet the Millennium Development Goals (MDGs). The commission aims to boost the importance of broadband on the international policy agenda and believes that expanding broadband access in every country is key to accelerating progress towards these goals by the target date of 2015. For more information, see: http://www.broadbandcommission.org/.

26 The prices and analysis in this section refer to the 161 countries for which 2011 ICT prices are available.

27 The R-squared value provides a measure of how good one variable is at predicting another. It varies from 0 to 1, the latter being the value obtained by a perfect fit of the data points. In the case of the IPB and GNI per capita, the higher the R-squared value, the stronger the correlation between IPB and GNI per capita.

28 The R-squared value provides a measure of how good one variable is at predicting another. It varies from 0 to 1, the latter being the value obtained by a perfect fit of the data points. In the case of the IPB and GNI per capita, the higher the R-squared value, the stronger the correlation between IPB and GNI per capita. The R-squared value of 0.58 for the fixed-telephone sub-basket compares with an R-squared value of 0.77 for both the mobile-cellular and the fixed-broadband sub-baskets.

29 In 2011, 65 per cent of all fixed-telephone subscriptions in Morocco were with Inwi/Wana, which only offers prepaid packages.

30 See endnote 27.

31 Serbian telecommunication minister Jasna Matic, see http://www.telegeography.com/products/commsupdate/articles/2010/11/30/mnp-set-for-march-debut/.

32 See http://afrinnovator.com/blog/2011/03/31/mobile-number-portability-in-kenya-%E2%80%93-an-april-fool/.

33 A study on the effects of MNP by Sean Lyons underlines the importance of the quality of MNP. It was found that when maximum porting time was less than five days, more customers switch and prices go down, see Lyons (2006).

34 See http://www.celulia.com/2011/01/nuevos-precios-de-claro-argentina-2011/ and http://www.redusers.com/noticias/la-que-faltaba-personal-tambien-aumentara-sus-tarifas-en-el-verano/.

35 See http://allafrica.com/stories/201103211231.html and http://www.cellular-news.com/story/47465.php?s=h.

36 See http://www.todayszaman.com/newsDetail_getNewsById.action;jsessionid=357326FA2A9FF456BF99442212B75C0D?newsId=205625.

37 See http://www.eiu.com/index.asp?layout=ib3Article&article_id=2015323586&country_id=1450000145&pubtypeid=1162462501&industry_id=810001081&category_id=&rf=0 as well as Boynudelik (2011).

38 See endnote 27.

39 See http://media.ofcom.org.uk/2011/07/20/better-value-rural-broadband/.

40 See http://www.telegeography.com/products/commsupdate/articles/2011/11/07/adsl-prices-now-below-arab-average-for-capped-plans-3g-prices-above-average/.

41 See http://www.asemana.publ.cv/spip.php?article63630&ak=1 and http://www.asemana.publ.cv/spip.php?article64037.

42 See http://guyanachronicleonline.com/site/index.php?option=com_content&view=article&id=38415:telecommunications-infrastructure-a-good-investment-for-guyana&catid=2:news&Itemid=3 and http://www.guyanachronicleonline.com/site/index.php?option=com_content&view=article&id=27549:gtat-reducing-cost-of-256k-dsl-service&catid=2:news&Itemid=2.

43 See http://www.digitalhome.ca/2011/11/bell-jacking-prices-of-phone-internet-and-tv-in-new-year/.

44 While the overview in this section is based on prices and averages only for the 144 countries for which prices are available for 2008, 2009, 2010 and 2011, the analyses for each region (which present and focus solely on the 2011 prices) include all (161) countries for which 2011 prices are available.

45 The regions in this chapter refer to the ITU/BDT regions, see: http://www.itu.int/ITU-D/ict/definitions/regions/index.html.

46 In Africa, fixed-broadband prices have fallen substantially between 2008 and 2011. However, since for the calculation of the IPB the three sub-basket values are capped at 100 (to reflect that prices cannot exceed monthly GNI per capita levels), the often very high decrease in fixed-broadband prices is not always mirrored in the change in IPB.

47 See endnote 45.

48 PPP$ values are based on World Bank data.

49 References to income levels are based on the World Bank classification, see: http://data.worldbank.org/about/country-classifications/country-and-lending-groups.

50 See http://www.telegeography.com/products/commsupdate/articles/2011/07/18/ghana-mobile-base-tops-19-19m-in-june-fixed-users-stable/.

51 See http://wirelessfederation.com/news/27094-zain-ghana-chops-down-call-rates-offers-free-sms/.

52 See http://www.cellular-news.com/story/47465.php?s=h.

53 See http://www.telecompaper.com/news/uganda-puts-limits-on-promotional-tariffs.

54 Legislation to introduce competition has been passed, but so far EriTel remains the sole mobile operator. Regarding Gambia, see also http://www.telegeography.com/products/commsupdate/articles/2010/07/27/qcell-toasts-achievements-signs-up-100000-mobile-users-in-first-year/.

55 See http://www.telegeography.com/products/commsupdate/articles/2012/01/10/lack-of-bandwidth-causes-problems-for-mtn-3g-network/.

56 See http://www.balancingact-africa.com/news/en/issue-no-403/internet/gambia-gets-bandwidt/en.

57 See http://www.ace-submarinecable.com/ace/default/EN/all/ace_en/the_project.htm, http://www.submarinecablemap.com/.

58 See http://www.cellular-news.com/story/45244.php?s=h.

59 See http://www.rdb.rw/departments/information-communication-technology.html.

60 According to the CTIA semi-annual survey, the average US-American citizen makes about 400 minutes of calls per month and sends some 200 sms. Operators have adapted by offering a large number of high-volume or unlimited packages, based on which the actual cost per minute and per call is much cheaper than the one on which the IPB is based. For example: "Tracfone offers its "Straight Talk" plan of unlimited minutes and text, nationwide, any time, for USD 45 a month, and Boost has a USD 50 a month plan that offers users unlimited talk, text, web and walkie-talkie service". See http://telecoms.cytalk.com/2011/05/us-canada-and-spain-win-the-battle-for-most-expensive-cellphone-bills/. Similarly, in its 2011 Communications Outlook, OECD confirms that "Users in the United States tended to make far larger average use of mobile telephony than in other countries, because of the more widespread use of unlimited voice services or large buckets of minutes", see OECD (2011).

61 See http://www.ft.com/cms/s/0/74e1a934-0914-11df-ba88-00144feabdc0.html#axzz1sU0BzEbd.

62 See http://www.anatel.gov.br/Portal/documentos/sala_imprensa/23-3-2012--15h50min36s-Redução-VC.pdf.

63 "In March [2011] Cofetel ordered that interconnection fees be reduced from 0.95 pesos ($0.08) to 0.39 pesos, taking Mexico from a relatively high rate to one of the lowest in the OECD. Retail prices have already fallen: Telcel cut the price of its off-net calls by two-thirds, and Telefónica by half. Telmex lowered the price of calls to mobiles (thereby probably reducing the national inflation rate). The cuts may not end there: Cofetel is considering applying "asymmetric regulation" to América Móvil, which could force it to charge less to its rivals than they charge it." See: http://www.economist.com/node/21546028. See also: OECD (2012b) and: http://www.totaltele.com/view.aspx?ID=472383.

64 See http://www.pyramidresearch.com/pr_prlist/PR111610_INSLA2.8.htm.

65 See http://www.fiercetelecom.com/story/finding-niche-mvnos-latin-america/2010-06-01.

66 See http://wirelessfederation.com/news/90633-virgin-mobile-to-launch-mvno-services-in-chile-in-2012-latin-america/.

67 See http://www.commsmea.com/11750-growth-factor/2/ as well as http://www.zawya.com/story.cfm/sidZAWYA20111030050118/Jordans_mobile_phone_market_booms_expands and http://www.cellular-news.com/story/43648.php?s=h.

68 See http://www.tra.gov.om/newsite1/NewsDetails.aspx?newsid=56 and http://www.prepaidmvno.com/2011/06/22/oman-telecom-sector-tough-competition-in-the-mobile-segment-and-growth-potential-for-the-fixed-and-broadband-zawya/.

69 See http://www.tra.gov.lb/TRA-presentations-2011.

70 See http://telecomlead.com/inner-page-details.php?id=6741&block=Service%20Provider and http://www.lankabusinessonline.com/fullstory.php?nid=1532697933.

71 See http://www.gartner.com/it/page.jsp?id=1963915.

72 See http://www.trai.gov.in/WriteReadData/PressRealease/Document/Press%20release%201%20er.pdf.

73 See http://www.wirelessintelligence.com/analysis/2012/01/china-approaches-1-billion-mobile-connections-as-3g-services-gain-traction/.

74 See http://www.gomonews.com/china-mobile-loses-profit-as-mobile-3g-users-go-elsewhere/ and http://quicktake.morningstar.com/err/abde/chl.pdf.

75 Like other operators in South Asia, those in Sri Lanka have adopted a 'budget telecom model', a business model which is based on low cost, low prices and high volume, aimed at being profitable even by serving low-income areas and populations. A key characteristic of this model is the reduction of network costs by "sharing passive and active infrastructure, by outsourcing key parts of the operation including even the management of the core network". On the end-user side, this model takes into account the often limited ability of consumers to pay for a monthly subscription, and is based on prepaid services. The model may also play an important role in spreading mobile-broadband services. See Galpaya (2011) and Box 2.2. in Simon (2011).

76 See http://www.uzdaily.com/articles-id-10951.htm.

77 See http://broadbandtoolkit.org/7.4.

78 While the price of the entry-level fixed-broadband basket has been the same since 2009, speeds have increased substantially, from 1 Mbit/s in 2009 to 6 Mbit/s in 2011.

79 See http://www.modernrussia.com/content/russias-strategy-competition-broadband-internet-access.

80 See http://ec.europa.eu/information_society/activities/roaming/regulation/archives/current_rules/index_en.htm.

81 See http://www.crc.bg/news.php?news_id=14&lang=en and http://www.euractiv.com/infosociety/eu-sanction-bulgaria-inflated-mobile-prices-news-506874.

82 See http://www.euractiv.com/infosociety/eu-sanction-bulgaria-inflated-mobile-prices-news-506874 and http://www.cellular-news.com/story/50420.php.

83 See http://www.telegeography.com/products/commsupdate/articles/2010/11/12/macedonia-gets-its-first-mvno-in-wti/ and http://www.telegeography.com/products/commsupdate/articles/2010/09/17/minister-hints-at-plan-to-open-mobile-market-to-mvnos/.

84 See the OECD broadband portal, which includes detailed country information on broadband services, uptake, speeds and prices: http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html.

85 Hereinafter referred to as "prepaid handset-based".

86 Hereinafter referred to as "postpaid computer-based".

[87] See endnote 10.

[88] See endnote 49.

[89] For a discussion on the connection of GNI p.c. levels and affordability of ICT services, see pp. 35-37 of this report.

[90] It has to be noted that the fixed-broadband sub-basket of the IPB and the results of this mobile-broadband price data-collection exercise are not strictly comparable, since they are based on different sets of countries.

[91] 121 countries that were included in both the 2011 IPB and the mobile-broadband price data-collection exercise.

[92] In Ireland, the operator Three monitors the data usage of its customers and reserves the right to limit service after a 15 GB per month threshold has been reached.

[93] Throttling is the limitation of data transfer rates to be sent or received by a device.

[94] Operators in Panama, Slovenia and Thailand throttle speeds as well, but to a bandwidth still considered as broadband (> 256 kbit/s).

[95] See Ofcom (2011c), p. 7.

[96] See http://www.cellular-news.com/story/51608.php?s=h.

[97] In Mongolia, for example, a volume of 1 GB of computer-based mobile-broadband access to be consumed within one month will cost prepaid customers USD 10.4 while postpaid customers pay USD 8.9 monthly. In Botswana, 1 MB costs USD 0.22 for prepaid and USD 0.12 to 0.13 for postpaid mobile-broadband subscribers. In Bahrain, for USD 26.3 prepaid mobile-broadband customers get 1 GB while postpaid mobile-broadband customers get a 4 GB data allowance per month, no matter which access device they use.

[98] See http://www.researchictafrica.net/countries.php?cid=15&rd=14.

[99] Including Belgium, Hungary, Iceland, Netherlands, Poland, Portugal, Romania and Spain, but also non-European countries such as Angola, Bolivia, Chile, Egypt, Lao PDR, New Zealand and Tanzania.

[100] This pricing scheme is rare in Europe and the Americas, but can be found for example in Armenia, Bhutan, Malawi, Nepal and Oman.

[101] Pay-as-you-go mobile-broadband prices are comparable to prepaid mobile-cellular prices, where customers are charged based on actual consumption (of minutes, sms).

[102] Generally, the more customers pay up front and the longer they commit, the cheaper the per MB rate gets. For example, for a 24-month contract Botswanan subscribers are charged at only USD 0.0222 per MB under the 2 GB plan.

[103] This is the case for example in Australia, Belarus, Belgium, France, Liechtenstein, Ireland, Maldives, Switzerland and United States.

[104] See overview of the EGTI meeting held during the 2011 World Telecommunication Indicators meeting (WTIM-11), at http://www.itu.int/ITU-D/ict/wtim11/documents/cont/012-E.pdf .

Chapter 4. Revenue and investment in telecommunications

4.1 Introduction

ICTs are not only changing the way people communicate and share information, but are also contributing significantly to economic growth in developed and developing countries alike. The impact of ICTs goes well beyond the ICT sector itself, because of the spillover effects that ICTs have in the rest of the economy. For this reason, ICTs have been widely acknowledged to be general purpose technologies (GPTs).[1] This means that, just as electricity or the railways did in the past, ICTs are playing an enabling role and unlocking economic growth in other sectors.

Unlike with older GPTs, the economic impact of ICTs may materialize more quickly owing to their rapid evolution and uptake. For instance, between the time mobile-cellular services were first introduced in the early nineties and 2009, mobile-cellular penetration worldwide more than doubled every four years. Today, there are more than 6 billion mobile-cellular subscriptions, bringing the benefits of ICT to areas not previously reached, and spurring the growth of the ICT sector.

The ICT sector has in itself become a major contributor to economic development. In 2010, global exports of ICT goods accounted for 12 per cent of world merchandise trade, and as much as 20 per cent in developing economies (UNCTAD, 2012). As regards ICT services, in 2010 the telecommunication industry incurred capital expenditure worth more than USD 241 billion, which represents about 2 per cent of the world's total investment in gross fixed capital formation.[2] In the same year, telecommunication sector revenues reached USD 1.5 trillion, corresponding to 2.4 per cent of the world's GDP.[3] Even if the ICT sector may be relatively small in relation to the overall economy, its contribution to productivity growth can be significant.

Indeed, investment in ICT capital increases labour productivity even in sectors that traditionally have not used ICTs.[4] Moreover, evidence shows that the relationship between investment in telecommunication equipment and IT hardware and software, and growth in labour productivity is stronger in developing countries (Van Ark, Gupta and Erumban, 2011). This is because developing countries (including emerging economies, such as Brazil, China, India and Mexico) generally have lower levels of ICT capital per worker than developed countries, and therefore benefit more from investment in ICT capital. Data show that the gap between the developed and developing countries is narrowing, the developing economies' share in global ICT investment having more than tripled, from 13 per cent in 1990 to 41 per cent in 2007 (Van Ark, Gupta and Erumban, 2011).[5] Despite the progress made, however, there is still ample room for additional economic growth in developing countries based on further ICT adoption in all sectors of the economy, since ICT uptake is still relatively low.[6]

In the following sections, this chapter first looks at the available economic data on the ICT sector in order to provide an overview of its economic weight and structure. Then, a more comprehensive analysis of the telecommunication sector is carried out on the basis of revenue and investment data, providing new insights into the situation in developing countries. The analysis

addresses issues such as the size of telecommunication markets and their weight in the economy, the capacity of the telecommunication sector to attract investments in both developed and developing countries, and the importance of foreign direct investment (FDI) in ICT developments. The chapter ends by drawing some conclusions and providing policy suggestions based on the data findings.

4.2 Role of the ICT sector in the economy

The ICT sector can be divided into two broad industries: ICT manufacturing and ICT services (Table 4.1).[7] The latter can be in turn divided into two main categories: telecommunication services and computer-related services.[8] Complete information on ICT markets thus goes beyond the traditional collection of data from telecommunication operators – which only represent a part of the sector – and requires a wider reach, such as that of national account systems or industrial sector surveys. Since the ICT sector is made up of diverse economic activities (e.g. manufacturing of consumer electronics, operation of web portals, provision of mobile-cellular services, etc.), harmonization to international classifications is crucial in order to obtain comparable ICT sector figures.

Data on the broader ICT sector allow a more complete analysis of the sector's impact on economic development, particularly in countries where other ICT activities apart from telecommunications have a significant weight. For example, the semiconductor industry, which is a part of the ICT manufacturing industry, generated more than USD 250 billion in revenues globally in 2011, with about 70 per cent of the market concentrated in Asia and the Pacific (OECD, 2010a). In Malaysia, it represented by itself 1.3 per cent of value added of total GDP (Ramasamy and Ponnudurai, 2011). Another example is India's ICT service industry, which is broader in scope than just telecommunications, and has a significant international projection: IT service exports accounted for nearly 15 per cent of India's total exports in 2008 (Malik and Mundhe, 2011). This is a reflection of the major importance attached to the business process outsourcing (BPO) industry in the country, which stretches beyond the ICT sector and includes the outsourcing of other services. These examples highlight the value of collecting ICT sector data in order to capture the full picture of the sector and measure its impact on economic development.

The ICT sector varies significantly across countries in terms of its contribution to total value added of the private sector,

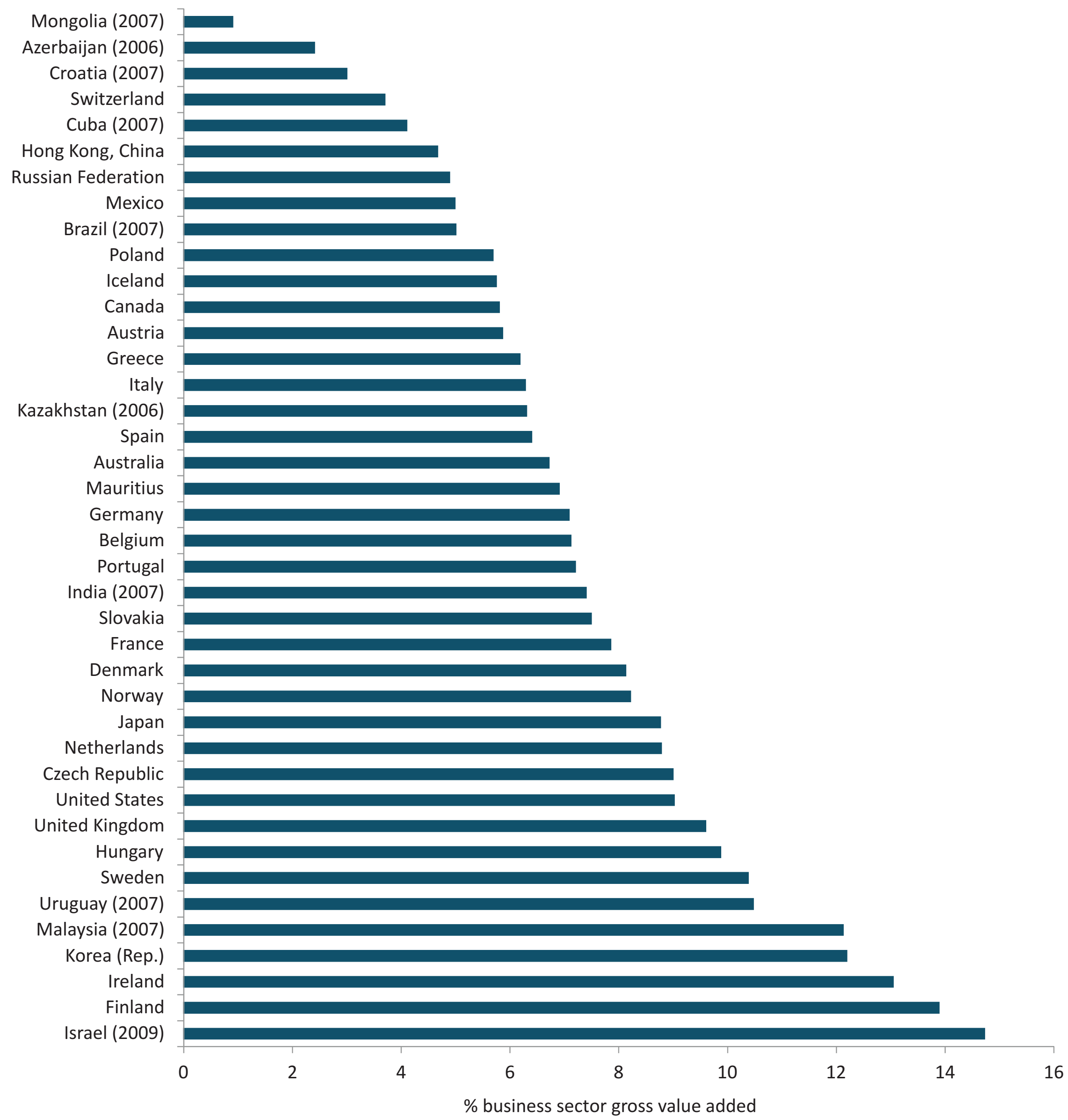
Table 4.1: ICT sector definition (based on ISIC Rev. 4)

ICT manufacturing industries
- 2610 Manufacture of electronic components and boards
- 2620 Manufacture of computers and peripheral equipment
- 2630 Manufacture of communication equipment
- 2640 Manufacture of consumer electronics
- 2680 Manufacture of magnetic and optical media
ICT trade industries
- 4651 Wholesale of computers, computer peripheral equipment and software
- 4652 Wholesale of electronic and telecommunications equipment and parts
ICT services industries
- 5820 Software publishing
- 61 Telecommunications
- 62 Computer programming, consultancy and related activities
- 631 Data processing, hosting and related activities; web portals
- 951 Repair of computers and communication equipment

Source: OECD (2009b) and Partnership (2010).

from less than 1 per cent in Mongolia to above 14 per cent in Israel (Chart 4.1). It represents a higher share of business-sector gross value added in countries that have relatively large ICT manufacturing or computer-related service sectors. For instance, Finland, Ireland and Israel are small countries that have taken advantage of globalization in order to develop innovative export-based ICT manufacturing and computer service sectors. Concrete examples of this ICT-led development include Finland's flagship mobile communication manufacturer, Nokia; Ireland's hub of software and IT service companies, which has attracted investment from the major multinational software companies;[9] and Israel's high-tech R&D facilities (OECD, 2010a; Roper and Grimes, 2005). The Republic of Korea and Malaysia are among the well-known Asian economies where ICT manufacturing has played an important role in economic development, becoming a driver of economic growth in periods of economic recession.[10]

Chart 4.1: Contribution of the ICT sector to total gross value added of the business sector, 2008



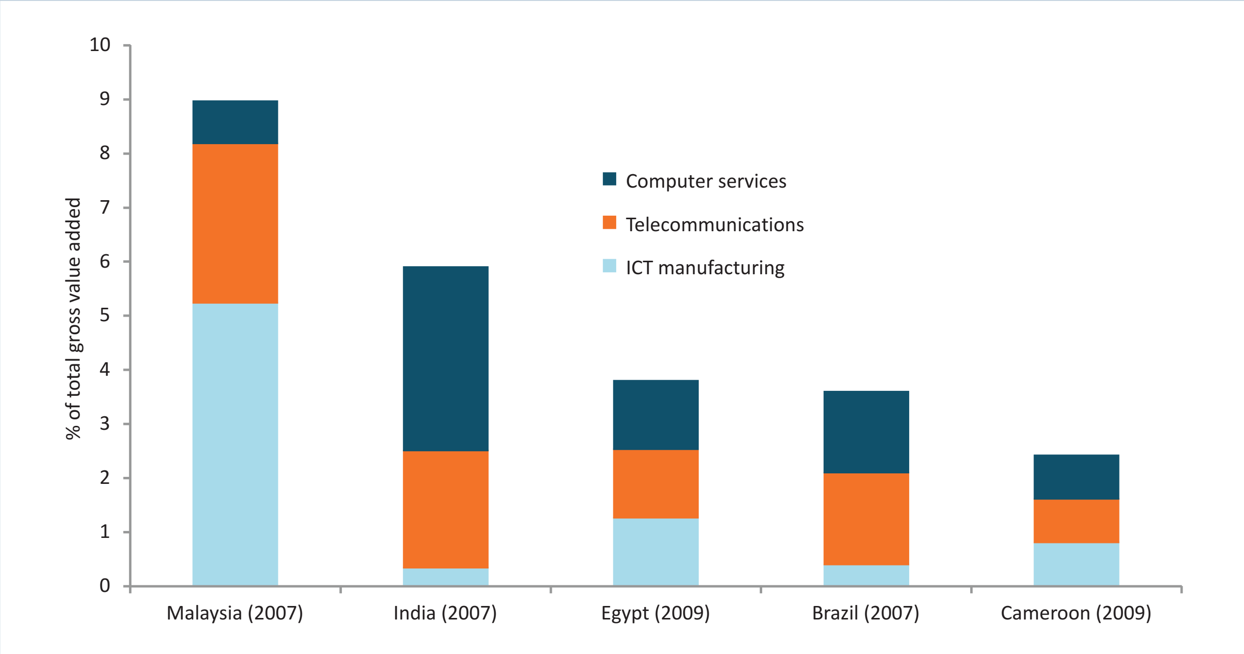
Source: OECD and UNCTAD, except for Brazil (Porcaro and Jorge, 2011) and India (Malik and Mundhe, 2011).
Note: Business-sector gross value added refers to the portion of gross value added that is attributable to the private sector.

Since the share of the ICT sector in total business-sector gross value added depends also on the overall size of the economy and its diversification, other countries which also boast large and innovative ICT sectors, such as Japan, the United Kingdom and the United States, are not at the top of the list. However, their ICT sector represents about 9 per cent of private-sector gross value added, which means that its contribution is still very significant in view of the size of their economies. On the other hand, in countries like Mongolia and Azerbaijan, the ICT sector represents less than 2.5 per cent of business-sector gross value added. This suggests that the ICT contribution to the economy could be significantly increased by developing telecommunication services, which are only one component of the total ICT sector.

Available data on the composition of the ICT sector show significant differences between countries (Chart 4.2). For instance, ICT manufacturing represents a very small share of total value added in Brazil, Cameroon,[11] Egypt[12] and India. However, in China and Malaysia it contributes more than 4 per cent of GDP (Malik and Mundhe, 2011; Ramasamy and Ponnudurai, 2011). These differences are explained by diverse economic structures within the ICT sector. Brazil is a country with a huge domestic market, and a major part of ICT manufacturing relies on the import of electronic components and devices which are assembled for final use in the country (Vasconcelos, 2010). Cellular telephones generate the biggest share of telecommunication equipment exports, and yet for every cellular telephone exported in 2011 more than ten were sold in the domestic market.[13] Since the Brazilian ICT manufacturing sector is geared to the assembly of electronic components, it creates less value added than other countries which cover a larger segment of the value chain and are much more focused on the export of ICT devices, such as Malaysia (Box 4.1).

On the other hand, Brazil has a relatively large ICT service sector (i.e. computer services and telecommunications in Chart 4.2) which benefits from the competitive advantage of having a big internal market. In Egypt, telecommunications

Chart 4.2: Contribution of the ICT sector and sub-sectors to total gross value added of the economy, latest available year



Source: Brazil: Porcaro and Jorge (2011); Cameroon: Nzépa, Tankeu and Esse (2011); Egypt: El-Shenawy (2011); India: Malik and Mundhe (2011); Malaysia: Ramasamy and Ponnudurai (2011).

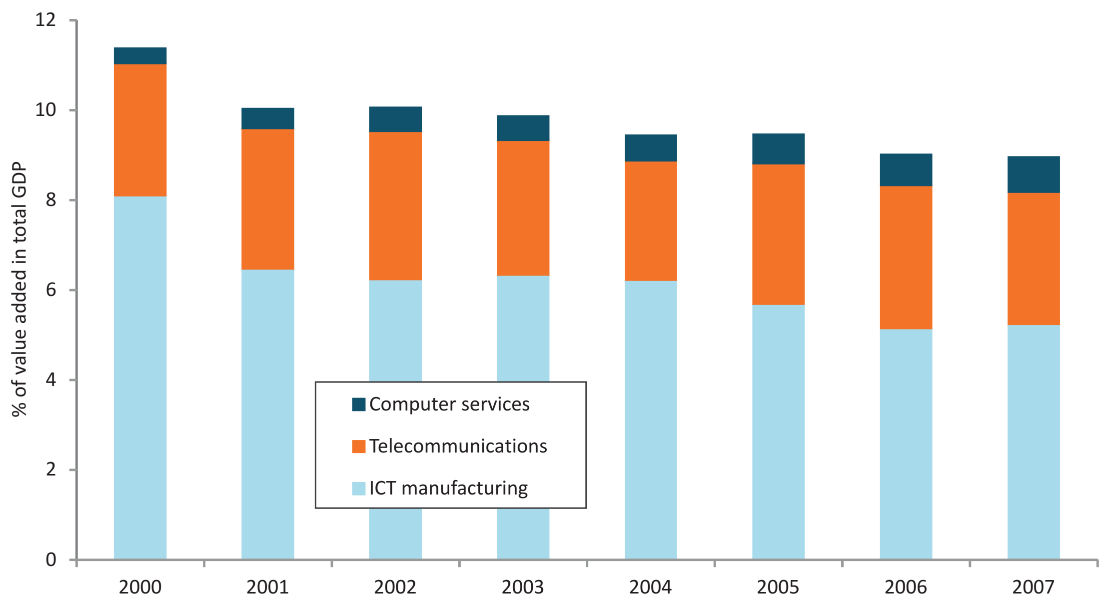
Note: National industrial classifications are not completely harmonized to the ISIC Rev. 4 or 3.1 classifications. As a result, the definitions of the ICT sector and sub-sectors do not exactly match for all countries included in the chart. In the case of India, posts is included with telecommunications. Other deviations are small, or lack of disaggregated data does not allow for an accurate assessment.

Box 4.1: The role of the ICT sector in economic development policies – the case of Malaysia

Malaysia is an example of the role that ICT policies can play in changing economic development strategies. In the 1970s, the country embarked on an industrialization programme in order to shift from a resource-based to an industrialized economy. This was incentivized with free trade zones to attract foreign direct investment (FDI), which by 1980 already accounted for 34 per cent of total investment, rising to an average of more than 50 per cent of total investment in the period 1981-2000. A significant proportion of this FDI – over a third of total manufacturing FDI in 2006-2008 – was concentrated in electrical and electronics manufacturing, and FDI provided more than 85 per cent of total investments in electrical and electronics manufacturing (Ramasamy and Ponnudurai, 2011). Electrical and electronics manufacturing thus became the major export industry in Malaysia, providing more than 40 per cent of total exports in the period 1997-2011 (DOSM, 2012), and its development explains the current weight of ICT manufacturing in the total value added of the economy.

Following the period of the industrialization programme, Malaysia adopted the National Vision Policy, covering the decade 2000-2010 and formulating strategies to move from an industry-based to a knowledge-based economy. In line with this goal, ICT services have grown in importance in the Malaysian economy, particularly in the light of the decrease in the value added of ICT manufacturing (Chart Box 4.1). Part of this change has been due to the implementation of the flagship initiative Multi-media Super Corridor (MSC) Malaysia, which aims to foster the development of ICT services in the country. By 2007, MSC Malaysia companies contributed 1.2 per cent of total value added in the economy out of a total 9 per cent contribution of the ICT sector (Ramasamy and Ponnudurai, 2011), thus showing the significant impact ICT policies can have on economic development.

Chart Box 4.1: Growing importance of ICT services in Malaysia, 2000-2007



Source: Ramasamy and Ponnudurai (2011).

dominates the ICT sector, which is among the fastest growing sectors in the Egyptian economy, with a compound annual growth in value added of 25 per cent in the period 2002-2009. This trend has been accompanied by increasing participation of the private sector, which accounted for nearly 70 per cent of total value added of the ICT sector (El-Shenawy, 2011).

In Cameroon, although the ICT sector is relatively small in comparison with that of other countries, growth in the tertiary sector in recent years has benefited from the strong performance of telecommunication services (Nzépa, Tankeu and Esse, 2011; World Bank, 2012). A particular feature of Cameroon's telecommunication sector is that more than

90 per cent of total telecommunication employees are in informal employment (Nzépa, Tankeu and Esse, 2011).[14] The key role of informal employment in Cameroon's telecommunication sector suggests that other African countries may be in the same situation. This highlights the importance of assessing the economic contribution of the informal telecommunication sector in countries where it may be relevant.

A common feature of ICT services is that they have shown to be relatively resilient to economic downturns (Nzépa, Tankeu and Esse, 2011; OECD, 2010a; Porcaro and Jorge, 2011). This has not been the case for ICT manufacturing, whose products are much more traded than services and are exposed to downturns in the general economic climate. This holds particularly true in specialized exporting countries, such as Japan, the Republic of Korea, China (OECD, 2010a) and Malaysia (Ramasamy and Ponnudurai, 2011).

Another general feature of the ICT sector is that it displays a high labour productivity, as shown by the fact that its share of total business-sector value added is higher than its percentage of total employment in the business sector (Table 4.2). This is true for developed and developing

Table 4.2: Contribution of the ICT sector to total value added and total employment in the business sector, 2008 or latest available year

Economy	% ICT sector value added to total business-sector value added	% ICT sector employment to total business-sector employment
Australia	6.7	4.7
Austria	5.9	4.9
Belgium	7.1	5.0
Brazil†	5.0	2.1
Hong Kong, China	4.7	3.1
Croatia†	3.0	1.9
Cuba†	4.1	2.7
Czech Republic	9.0	5.8
Denmark	8.1	7.0
Finland	13.9	9.3
France	7.8	6.3
Germany	7.1	5.2
Greece	6.2	3.5
Hungary	9.9	7.7
Ireland	13.0	7.5
Israel#	14.7	8.5
Italy	6.3	5.3
Japan	8.8	7.5
Korea (Rep.)	12.2	6.1
Malaysia†	12.1	7.1
Mauritius	6.9	5.6
Mexico	5.0	2.2
Netherlands	8.8	6.5
Norway	8.2	6.2
Russian Federation	4.9	4.6
Slovakia	7.5	5.9
Spain	6.4	3.6
Sweden	10.4	8.4
United Kingdom	9.6	6.1
United States	9.0	4.0
Uruguay†	10.5	2.9

Source: UNCTAD.
Note: † 2007 data. # 2009 data.

countries alike, proving that jobs in the ICT sector are in general more productive than in other sectors.[15]

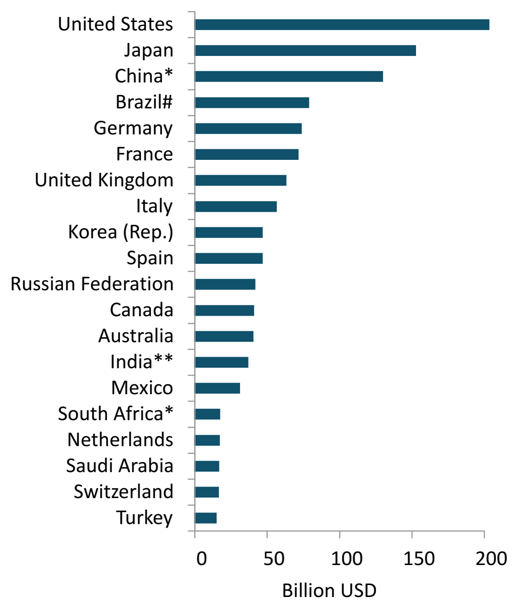
4.3 The telecommunication market

Telecommunication revenues

The size and importance of the telecommunication sector within an economy can be analysed on the basis of the revenues that it generates. Although telecommunication services have spillover effects that go beyond the sector itself, these gains are founded on the services which operators offer, and therefore telecommunication revenues are a first proxy of the overall importance of the sector for the economy.

The list of the 20 largest telecommunication markets includes the world's major economies (Chart 4.3), whose total GDP accounts for 80 per cent of world GDP.[16] The United States is by far the largest telecommunication market, with over USD 350 billion in total telecommunication revenues in 2010, more than twice as much as Japan, the second largest telecommunication market (USD 150 billion). The top twenty largest telecommunication markets also include big emerging economies, such as Brazil, the Russian Federation, India, China and South Africa (BRICS).

Chart 4.3: Top 20 largest telecommunication markets in terms of revenue from telecommunication services, 2010



Source: ITU.
Note: *Data from operators' annual reports – China: China Mobile, China Telecom and China Unicom; South Africa: Cell-C, MTN, Telkom and Vodacom. ** ITU estimate. # 2009 data.

This highlights the economic potential of telecommunication services in emerging countries with large domestic markets. There is no unique policy approach to foster development of the telecommunication sector. In China, for example, competition has been structured around three local operators that compete for the market: China Mobile, China Telecom and China Unicom. In the case of mobile services, competition is based on the deployment of different 3G technologies by each operator: CDMA2000 (China Telecom), WCDMA (China Unicom) and the domestically-developed standard TD-SCDMA (China Mobile).

In Brazil, on the other hand, the market is dominated by large international groups such as Telefónica, América Móvil and Telecom Italia. The presence of international groups in the telecommunication sector dates back to 1998, when the former incumbent Telebrás was divided into 12 different businesses – including fixed telephony, mobile-cellular services and long-distance telephone services – and privatized. Later, in the first decade of the 2000s, the Brazilian telecommunication market underwent a consolidation process, which yielded the three above-mentioned international groups and a fourth national group (Oi). The presence of international groups has contributed to modernizing the telecommunication infrastructure in the country and thus fuelled revenue growth. Indeed, in the period 1999-2009, total telecommunication revenues grew at a compound annual growth rate (CAGR) of 18 per cent, making the country the fourth largest telecommunication market in the world.

In the Russian Federation, telecommunication markets are dominated by large national operators – such as MTS, MegaFon, VimpelCom or Rostelecom. Most of them have become international operators by extending their footprint to other countries, particularly in the CIS region. At the same time, the market also includes foreign-based operators,

either as stakeholders of some of the main groups – as in the case of Telenor and TeliaSonera – or directly as service providers – case of Tele2. The Indian telecommunication market similarly has a mixture of big national operators – such as Bharti Airtel, Reliance Communications or the state-owned BSNL – and large foreign-based operators – e.g. Vodafone and Telenor. These examples highlight the different structures of telecommunication markets in large developing countries, which are greatly influenced by the regulatory policies adopted.

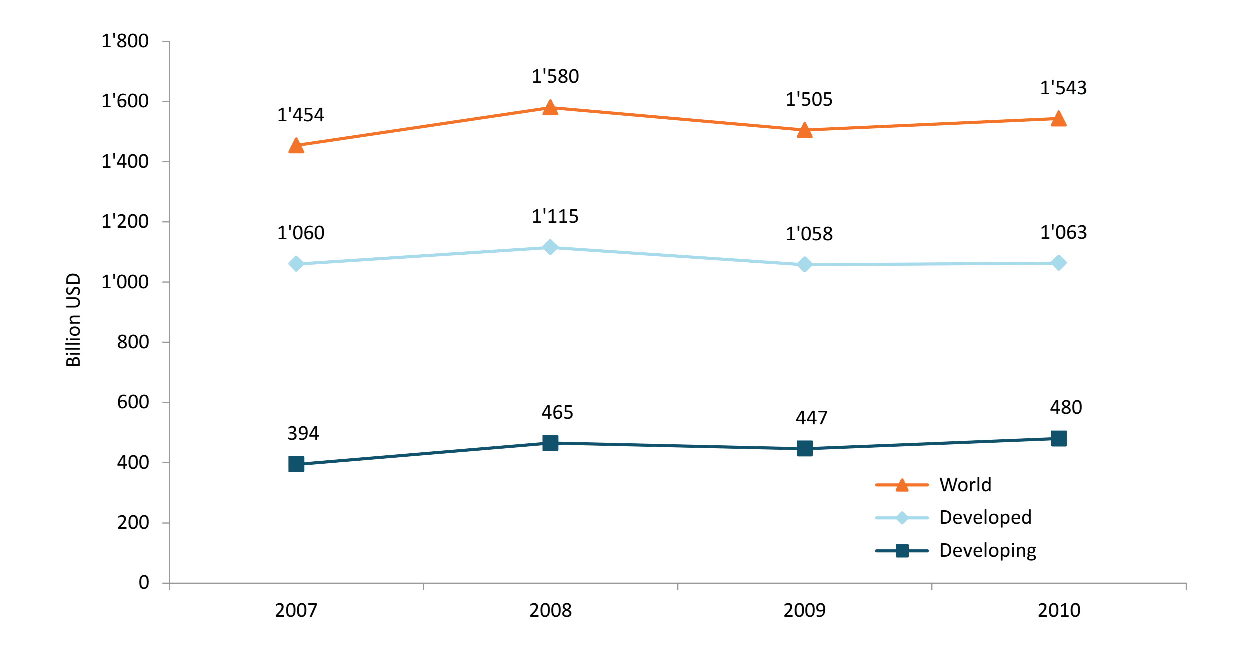
Other countries that stand out in the list of the 20 largest telecommunication markets are Saudi Arabia and Switzerland. Both these countries are relatively small in terms of population and total size of the economy (i.e. GDP), yet big in terms of total telecommunication revenues. In the case of Switzerland, the country is among the top 15 worldwide in terms of ICT uptake (see Chapter 2). Moreover, it has one of the highest levels of GNI per capita, which makes the high prices of some telecommunication services affordable in terms of income.[17] This explains the high spending on telecommunication services and therefore the high value of total telecommunication revenues. Saudi Arabia is not among the largest markets worldwide, but it is the largest economy in the Arab States in terms of total GDP. Moreover, some of the biggest regional telecommunication operators – Zain, Etisalat and STC – compete in the market, offering both fixed-broadband and mobile-broadband services. All three have launched LTE services, and Etisalat (Mobiliy) and STC are deploying FTTH networks (ITU, 2012). The deployment of these networks makes it possible to offer advanced data services and interactive applications, and it is these that are currently driving expenditure growth in the country (CITC, 2011).

The global value of telecommunication revenues – based on the available information from 55 countries that generate 92 per cent of world GDP – shows that the market increased by a moderate 6 per cent in the period 2007-2010 (Chart 4.4). The growth in telecommunication revenues came from the developing countries, while in the developed countries telecommunication revenues stagnated. Indeed, telecommunication revenues in developing economies increased by 22 per cent from 2007 to 2010, thus raising the share of telecommunication revenues from developing countries in the world total from 27 per cent in 2007 to more than 31 per cent in 2010. Data availability for developing countries is limited to economies representing 79 per cent of GDP in the developing world, while data from developed countries are almost complete and correspond to nearly 100 per cent of GDP in the developed world. Taking this into account, telecommunication revenues in developing countries can be estimated to represent about 35 per cent of total world telecommunication revenues in 2010. This figure is similar to the developing countries' share of total world GDP, i.e. 33 per cent in 2010.[18] The growing importance of developing countries in the global economy is therefore mirrored by a growing importance of their telecommunication sectors, which supports the argument that ICTs are enablers of economic growth.

Chart 4.4 shows that there was an overall decline in telecommunication revenues from 2008 to 2009, coinciding with the financial crisis. Data in local currency show that, in the majority of developed countries, telecommunication revenues decreased from 2008 to 2009, whereas in most developing countries (23 out of 27) they continued to increase (Table 4.3).[19] The diverging trends in developed and developing economies persisted in 2009-2010, when only half of the developed countries included in the analysis saw an increase in telecommunication revenues, while most developing countries continued the upward trend. These findings are consistent with the fact that developing countries have weathered the financial crisis better than developed countries. On the basis of the available data, all the countries that have experienced a continuous year-to-year decrease in telecommunication revenues in the period 2007-2010 are from the developed world, namely Austria, Denmark, Estonia, Germany, Greece, Hungary, Ireland, Italy and Japan.

This can be explained by the impact that the financial crisis (particularly in Europe) has had on usage and consumer behaviour in respect of telecommunication services (Arthur D. Little and Exane BNP Paribas, 2012). The crisis has most probably led to a contraction in telecommunication spending. However, since subscriptions (except for fixed telephony) have continued to increase, this suggests that consumers have not stopped using telecommunication services, but have either reduced usage or benefited from lower prices. Having said that, telecommunication markets in most developed countries are highly competitive and

Chart 4.4: Total telecommunication revenues, 2007-2010, world and by level of development



Source: ITU.
Note: 'World' includes 55 countries accounting for 92 per cent of world GDP. 'Developed' includes 28 developed countries accounting for 98 per cent of total GDP in the developed world. 'Developing' includes 27 developing countries accounting for 79 per cent of total GDP in the developing world.

reaching saturation in some segments, such as mobile-cellular services. Moreover, as in other countries where uptake of new data services is spreading, operators face the revenue pressure exerted by new applications which are cannibalizing some of the traditional revenue streams (e.g. WhatsApp as opposed to sms; Skype or Vonage instead of fixed-telephone calls). This, together with the overall context of economic contraction, explains the stagnation of telecommunication revenues in developed countries. There are nevertheless some exceptions to this trend, such as Canada and Sweden, which have experienced sustained growth in telecommunication revenues in the period 2007-2010. These countries are among the most advanced in terms of the deployment of next-generation networks (e.g. LTE and FTTH in the access part), which generate revenue growth from advanced data services and also savings in operating expenditure. This highlights the importance of broadband development for future growth in telecommunication revenues.

In contrast, most developing countries still have ample room for growth in telecommunication revenues by extending service coverage to reach a larger proportion of the population. Examples of developing countries with sustained and strong telecommunication revenue growth include Argentina, Colombia, Egypt, India, Kenya, Nigeria, Pakistan, Saudi Arabia and Venezuela. These countries experienced a telecommunication revenue CAGR of more than 10 per cent during the period 2007-2010.

An indication of the weight of telecommunication services in the total economy is obtained from the ratio of telecommunication sector revenues to total GDP. The results need to be interpreted with care, since the truly accurate measure would be the ratio of value added of the sector to total GDP, but there is a lack of disaggregated data on the valued added of telecommunication services. Using revenues instead of value added of the sector overestimates its contribution to GDP, and the figures in Chart 4.5 should therefore be interpreted with caution.

In 2010, the ratio of telecommunication revenues to total GDP ranged from 1.3 per cent in Norway to 10 per cent in Senegal. In most developed countries, telecommunication

Table 4.3: Revenue from all telecommunication services, 2007-2010, millions

	2007	2008	2009	2010	
Economy	Local currency	Local currency	Local currency	Local currency	USD
United States	337'496	348'685	342'334	352'860	**352'860**
Japan	15'306'273	14'405'535	14'218'173	13'368'239	**152'293**
China	739'860	814'800	854'409	876'393	**129'452**
Brazil	119'848	177'908	156'928	N/A	**78'503'**
Germany	60'705	58'874	56'776	55'352	**73'314**
France	51'516	53'629	53'216	53'680	**71'099**
United Kingdom	42'010	42'460	41'410	40'550	**62'674**
Italy	46'142	45'205	43'800	42'328	**56'064**
Korea (Rep.)	45'303'700	48'703'427	50'983'906	53'605'969	**46'370**
Spain	37'720	38'213	36'270	34'982	**46'334**
Russian Federation	967'629	1'136'409	1'180'413	1'255'223	**41'334**
Canada	38'205	40'200	40'900	41'700	**40'485**
Australia	40'200	39'779	40'915	43'553	**39'957**
India	1'073'820	1'294'600	1'523'600	1'662'246	**36'352**
Mexico	317'566	337'320	362'663	387'226	**30'645**
South Africa*	106'202	115'541	121'170	124'006	**16'938**
Netherlands	12'376	13'076	12'890	12'692	**16'811**
Saudi Arabia	43'000	48'018	52'500	61'000	**16'267**
Switzerland	16'343	16'533	16'686	16'777	**16'085**
Turkey	21'129	23'151	24'092	21'764	**14'481**
Poland	41'973	43'261	43'270	43'586	**14'456**
Indonesia*	103'551'800	109'300'000	116'314'900	122'347'400	**13'459**
Venezuela	20'919	25'503	28'022	33'946	**13'127**
Colombia	16'977'000	17'643'000	21'065'000	22'865'530	**12'044**
Argentina	25'678	32'508	35'528	42'173	**10'825**
Belgium	8'071	7'913	7'850	7'906	**10'471**
Portugal	7'254	7'705	7'571	7'600	**10'066**
Greece	8'487	8'215	7'767	6'923	**9'170**
Malaysia*	24'593	26'710	27'568	29'002	**9'004**
Israel	27'491	28'277	29'036	30'108	**8'052**
Thailand*	239'701	245'224	239'368	250'770	**7'914**
Sweden	49'931	49'950	51'241	52'920	**7'342**
Denmark	44'314	41'435	40'709	40'557	**7'211**
Egypt	29'207	33'668	36'736	39'207	**6'974**
Nigeria	659'284	842'504	933'734	1'002'546	**6'670**
Czech Republic	131'614	141'358	134'052	125'520	**6'572**
Austria	5'743	5'175	4'966	4'774	**6'323**
Norway	31'271	31'882	32'564	33'260	**5'503**
Ireland	4'536	4'515	4'037	3'865	**5'119**
Peru	10'451	11'695	12'022	12'761	**4'517**
Morocco	29'583	32'477	34'461	36'203	**4'301**
Hungary	1'061'709	1'002'090	918'075	889'177	**4'276**
Pakistan	235'613	278'509	333'882	357'712	**4'199**
Kazakhstan	368'446	427'756	438'434	479'905	**3'257**
Slovakia	62'550	67'394	2'123	1'981	**2'624**
Kenya	110'433	132'655	142'141	150'003	**1'893**
Belarus	2'983'331	3'625'112	4'357'527	5'010'962	**1'682**
Slovenia	1'018	1'140	1'164	1'182	**1'566**
Oman	550	596	635	581	**1'509**
Senegal	529'000	598'000	607'000	635'000	**1'282**
Estonia	11'587	11'209	11'202	11'135	**943**
Panama	742	887	883	871	**871**
Costa Rica	306'657	326'629	349'401	373'761	**711**
Georgia	1'100	1'300	1'250	763	**428**
Iceland	39'665	42'616	43'140	43'366	**355**

Source: ITU World Telecommunication/ICT Indicators database
Note: Data in italics are ITU estimates. * Data from operators' annual reports. Figures for China (2010) represent also data collected from the main operators. USD data for Brazil correspond to 2009.

Box 4.2: The challenge of harmonizing revenue indicators – what is included in total telecommunication revenues?

Data on revenues from telecommunication services are usually collected by ministries and regulators on the basis of the information reported by the main operators. In other words, revenue data are obtained together with other administrative data such as number of subscriptions, network capacity, traffic, etc. In some countries, telecommunication revenue data are collected by national statistical offices through national account systems or industry surveys.

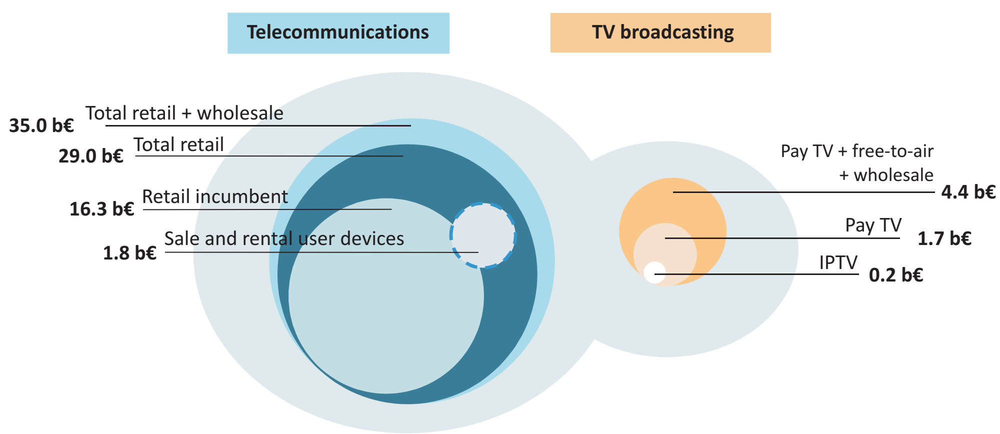
The extent to which revenue data are disseminated varies from country to country. In some cases only the total aggregate figure is published, while in other instances disaggregated data by operator or by service are also made public. The main challenge in respect of revenue data lies more in lack of harmonization than lack of data. In many cases it is not clear what a country reports under a given figure for telecommunication revenues, and in the cases where it is clear definitions may vary significantly between countries, making international comparisons difficult.

Figure Box 4.2 provides a breakdown of revenues from telecommunication services in Spain, as an example to illustrate how total telecommunication revenues values vary depending on what is included. For instance, in most OECD countries total telecommunication revenues are reported as the sum of retail and wholesale revenues, the latter including interconnection revenues as the main item. However, Israel, Norway and Sweden report only retail revenues. In several developing countries it is unclear whether data reported correspond to retail only or also include wholesale revenues. In the case of Spain, the inclusion of wholesale revenues makes a 20 per cent difference in total telecommunication revenues. This gives an idea of the distortion that may arise from comparing data from countries that include wholesale revenues in total telecommunication revenues with countries that do not.

Another, albeit less serious, source of inaccuracy is whether or not revenues from the sale and rental of end-user devices are included, such as the revenues obtained by a mobile operator from the sale of a smartphone. In Spain, this represents some 6 per cent of total telecommunication revenues, although it may be more significant in other countries or become so in the future, in line with the trend in some markets towards bundling sales of devices with telecommunication subscriptions.

An additional source of distortions is the extent to which some broadcasting revenues are included within the telecommunication sector. Since the frontiers between traditional broadcasting services and telecommunication services are blurring owing to the convergence of networks, services and devices, it is to be expected that separation of broadcasting and telecommunication revenues will become increasingly difficult. A clear example of this is IPTV, which in many OECD countries is already counted in telecommunication services. As IPTV currently accounts for only a small proportion of total retail telecommunication revenues (less

Figure Box 4.2: Breakdown of telecommunication revenues in Spain, 2010, billion EUR



Source: CMT Annual Report 2010, available at: http://informeanual.cmt.es.
Note: Retail revenues from the incumbent include both the fixed-line operator (Telefónica) and its mobile arm (Movistar). Total broadcasting revenues (EUR 4.4 billion) exclude subsidies, which in 2010 amounted to EUR 2.2 billion.

Box 4.2: The challenge of harmonizing revenue indicators – what is included in total telecommunication revenues? (continued)

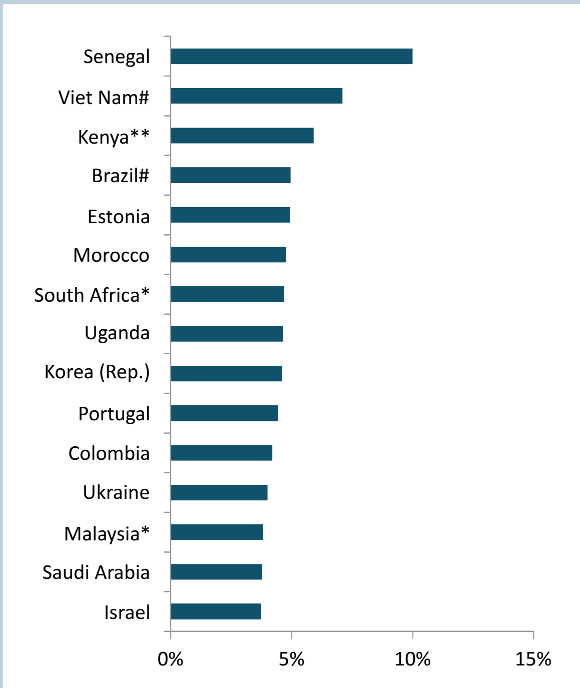
than 1 per cent in Spain), it remains as a minor source of error, but it may grow in importance in the future. One factor which already today represents a significant source of discrepancies in total telecommunication revenues is the inclusion or not of pay-TV services or (even broader) the whole audiovisual sector, i.e. pay-TV, free-to-air TV and wholesale TV revenues. In Spain, the inclusion of pay-TV revenues would make a 6 per cent difference in total retail telecommunication revenues, and inclusion of the whole audiovisual sector would result in a 17 per cent variation. Some OECD countries such as the Czech Republic, Estonia and Hungary include audiovisual revenues within total telecommunication services. Other countries, such as Israel or Portugal, include only pay-TV revenues. In several developing countries it is unclear to what extent pay-TV or total audiovisual revenues are included within data reported for telecommunication revenues.

In conclusion, the challenge that lies ahead is to harmonize telecommunication revenue data in order to improve their international comparability. In most cases, rather than collecting new data, this would mean reaching an agreement on a common methodology to follow when aggregating the data reported by operators and submitting them to ITU. Therefore, the ITU Expert Group on Telecommunication/ICT Indicators (EGTI) is currently reviewing these indicators with a view to progressing towards international harmonization of these data.[20]

revenues correspond to less than 3.5 per cent of total GDP, while in several developing countries the ratio is higher. Indeed, the top 15 countries with the highest ratio of telecommunication revenues to GDP are mainly developing countries (Chart 4.5). This suggests that the direct contribution of the telecommunication sector to economic growth tends to be greater in developing than in developed countries. In some cases, this may be a sign of less diversification in the economy, which would explain why telecommunication revenues carry more weight. Among the developed countries, the most remarkable exception is Estonia, where telecommunication revenues account for nearly 5 per cent of total GDP. This might be explained by the fact that it is a small country with high ICT uptake, particularly in respect of mobile services (see Chapter 2 of this publication and ITU, 2009b, 2010). In addition, revenue figures from Estonia also include broadcasting revenues (i.e. pay-TV and free-to-air TV revenues) and therefore cover a broader scope than data reported by most developed countries (Box 4.2).

Developing countries like Kenya, Senegal and Viet Nam stand out for the high proportion of GDP attributable to telecommunication revenues. This suggests that the telecommunication sector is already a major direct contributor to economic growth in these countries. In all three cases, mobile-cellular services have played a key role in extending the user base of telecommunication services. Viet Nam, for instance, boasts one of the highest mobile-cellular penetration rates (143 per 100 inhabitants in 2011)

Chart 4.5: Top 15 countries with highest ratio of telecommunication revenues to GDP, 2010



Source: ITU.
Note: * Data from operators' annual reports – Malaysia: Celcom, DiGi, Maxis and TM; South Africa: Cell-C, MTN, Telkom and Vodacom. ** ITU estimate. # 2009 data.

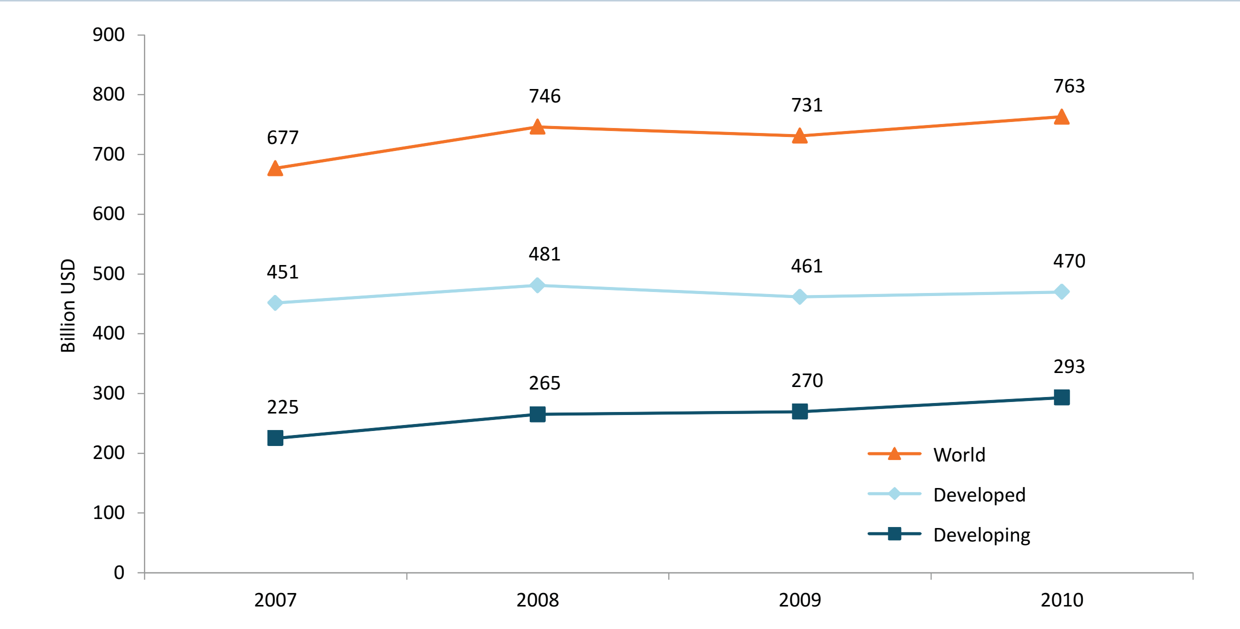
of all countries with similar income levels.[21] Kenya has been a pioneer country in terms of innovative mobile applications, such as mobile-banking services, which are now used by 68 per cent of adults in the country, the highest proportion of mobile-money users in the world (Demirguc-Kunt and Klapper, 2012). At the same time, Kenya, Senegal and Viet Nam also stand out among developing countries for having more than 40 per cent of total telecommunication revenues that are not due to mobile-cellular services. This highlights the importance of other telecommunication revenues, such as those from fixed-broadband services, in countries where the telecommunication sector contributes significantly to total GDP. These findings suggest that developing countries need to look beyond developments in mobile-cellular services in order to raise telecommunication revenues to a level where they have a significant impact in the overall economy.

Mobile revenues

The global value of mobile revenues[22] has followed a similar pattern to total telecommunication revenues. During the period 2007-2010 there was an overall increase of 13 per cent in mobile-cellular revenues worldwide, mainly driven by the growth in developing countries, which saw mobile revenues increase by 30 per cent (Chart 4.6). Mobile revenues in developed countries only rose by 4 per cent in the same period, and in fact experienced a contraction between 2008 and 2009, which explains the decrease in the global figure in those two years. This decrease coincides with the financial crisis, and is further explained by the context of growing competition in mobile-cellular markets in the developed world and the saturation levels reached in traditional mobile-cellular services.[23]

Mobile revenue data in local currency show that revenues from mobile services increased in almost all developing countries for which data were available in the period 2007-2010 (Table 4.4).[24] Developing countries with remarkable and sustained growth in the period include Egypt, Kazakhstan, Malaysia, Nigeria, Pakistan, Uzbekistan and Venezuela, all of which registered a mobile revenue CAGR of more than 15 per cent. In these countries, revenue growth has been driven by significant growth in mobile-cellular subscriptions. This is also the case in Nigeria and Pakistan, which, despite still having low mobile-cellular penetration rates (below 60 per

Chart 4.6: Revenues from mobile services, 2007-2010, world and by level of development



Source: ITU.
Note: 'World' includes 55 countries accounting for 90 per cent of world GDP. 'Developed' includes 27 developed countries accounting for 95 per cent of total GDP in the developed world. 'Developing' includes 28 developing countries accounting for 81 per cent of total GDP in the developing world.

Table 4.4: Revenue from mobile services, 2007-2010, millions

	2007	2008	2009	2010	
Economy	Local currency	Local currency	Local currency	Local currency	USD
United States	141'464	152'358	155'976	165'935	**165'935**
China	422'947	504'795	569'495	596'499	**88'109**
Japan	7'493'100	6'961'000	6'712'000	6'492'300	**73'961**
Brazil	54'650	70'016	72'024	N/A	**36'030**
Germany	25'800	25'500	25'200	25'840	**34'225**
France	23'127	24'237	24'514	24'605	**32'589**
United Kingdom	18'271	18'897	18'289	17'714	**27'379**
Italy	24'354	18'350	17'860	17'510	**23'192**
Korea (Rep.)	19'694'290	20'923'323	21'984'795	22'854'937	**19'770**
Russian Federation	456'096	545'116	554'600	593'700	**19'550**
India†	623'647	740'186	796'093	851'886	**18'630**
Spain	14'887	15'068	14'457	14'024	**18'575**
Canada	14'700	16'036	16'900	18'000	**17'476**
Mexico	159'017	173'315	197'705	220'027	**17'413**
South Africa*	73'630	81'882	87'324	90'562	**12'370**
Saudi Arabia	34'000	37'561	39'100	45'110	**12'029**
Turkey	12'793	12'483	12'973	13'838	**9'207**
Malaysia	18'700	24'100	26'000	29'000	**9'003**
Indonesia*	60'460'800	66'907'800	72'654'300	79'071'100	**8'698**
Netherlands	4'375	6'660	6'606	6'425	**8'509**
Venezuela	12'320	14'466	17'426	20'183	**7'805**
Argentina	17'719	19'854	*21'634*	*24'832*	*6'374*
Nigeria	613'808	768'671	891'945	950'400	**6'323**
Thailand*	182'237	187'838	182'551	193'055	**6'093**
Greece	4'594	4'498	4'263	4'263	**5'646**
Belgium	4'100	4'088	4'104	3'961	**5'246**
United Arab Emirates	13'179	17'319	17'787	18'400	**5'010**
Colombia	8'169'000	8'628'000	8'477'000	8'985'000	**4'733**
Switzerland	4'878	5'045	4'630	4'907	**4'705**
Israel	15'512	15'946	16'290	17'047	**4'559**
Egypt	16'712	20'897	23'929	25'576	**4'549**
Austria	3'453	3'269	3'177	3'071	**4'068**
Czech Republic	75'831	117'421	80'874	74'280	**3'889**
Sweden	18'652	20'497	22'349	25'110	**3'484**
Portugal	2'915	2'717	2'721	2'529	**3'349**
Morocco	21'971	23'628	24'124	25'949	**3'083**
Algeria	191'700	214'830	222'100	*225'606*	*3'033*
Denmark	17'510	16'707	16'540	16'937	**3'012**
Norway	15'085	15'650	16'398	17'301	**2'863**
Finland	2'247	2'027	2'100	2'150	**2'848**
Pakistan	133'132	182'122	212'423	236'047	**2'771**
Ukraine	25'061	29'630	28'511	28'838	**3'634**
Ireland	2'051	2'057	1'812	1'694	**2'243**
Kuwait*	567	609	601	632	**2'201**
Kazakhstan	123'831	211'048	244'820	260'945	**1'771**
Slovakia	40'356	44'756	1'354	1'290	**1'708**
Oman	351	408	413	441	**1'145**
Uzbekistan*	477'145	890'516	1'115'715	1'381'833	**871**
Belarus	1'677'182	1'807'947	2'115'473	2'148'296	**721**
Senegal	282'000	336'000	327'000	346'000	**699**
Slovenia	470	512	527	512	**678**
Panama	354	487	502	501	**501**
Estonia	6'974	6'434	5'860	4'782	**405**
Georgia	705	831	812	547	**307**
Iceland	16'250	15'906	15'443	14'865	**122**

Source: ITU World Telecommunication/ICT Indicators database.

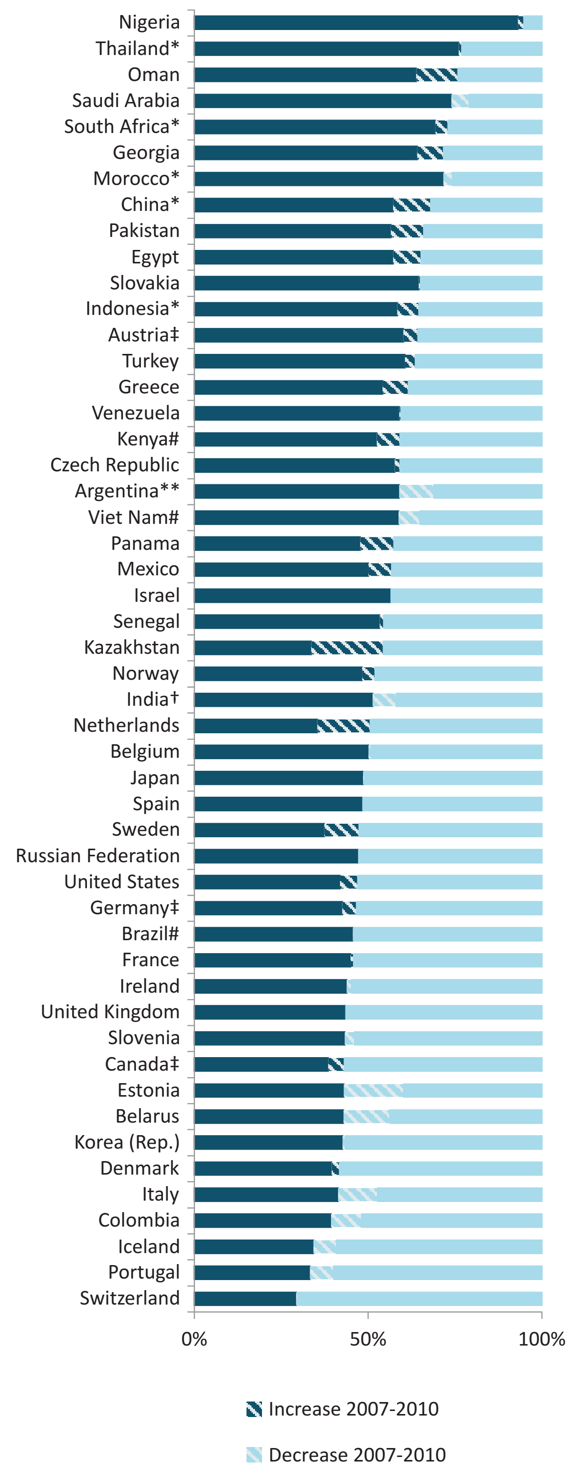
Note: Data in italics are ITU estimates. * Data from operators' annual reports. Figures for China (2010) and Kazakhstan (2008) represent also data collected from the main operators. USD data for Brazil correspond to 2009. † Data based on ARPU and subscriptions quarterly figures published by TRAI.

cent in 2010), added some 36 million and 46 million mobile subscriptions, respectively, between 2007 and 2010.

On the other hand, the majority of developed countries saw a decrease in mobile revenues from 2007 to 2010, recording a lower figure in national currency in 2010 than in 2007. Notable exceptions are Canada, the Netherlands, Sweden and the United States, where mobile revenues grew at a CAGR of 5 per cent or more during the four years. The mobile revenue growth in these countries is to a large extent explained by the increase in revenues from mobile data services. The Netherlands and Sweden are paradigmatic cases: not only are they the developed countries which experienced the highest mobile revenue growth between 2007 and 2010 (above 10 per cent CAGR), but also, unlike Canada and the United States (which were among the few developed countries with less than 100 per cent mobile-cellular penetration in 2010), they both had already reached a mobile penetration rate above 100 per cent in 2006. The high revenue growth from 2007 to 2010 is mainly explained by the increase in mobile data traffic, which accounted for as much as 60 per cent of the revenue growth in the period in Sweden.[25] This highlights the importance of mobile data revenues, which are already considered in developed countries as 'the single most important growth driver in the sector' (Arthur D. Little and Exane BNP Paribas, 2012). Developing countries can also take advantage of this growing revenue source by accelerating the transition to 3G and more advanced networks, such as LTE.

The mobile sector has become a prime source of revenues in developed and developing countries alike. However, the share it represents in total telecommunication revenues varies greatly across countries: from more than 90 per cent in Nigeria to less than 30 per cent in Switzerland (Chart 4.7). These differences reflect the diverse stages of development of the mobile sector, as well as differences in the fixed-network infrastructure – Switzerland had 15 times as many fixed-broadband subscriptions as Nigeria in 2011, although Nigeria's population is 20 times bigger. On average, mobile revenues represented 47 per cent of total telecommunication revenues in developed countries, compared with 62 per cent in developing countries.[26] Indeed, in many developing countries fixed telecommunication infrastructure is underdeveloped, whereas mobile networks have rapidly expanded in the last decade. This is visible in the weight of mobile revenues in total telecommunication

Chart 4.7: Share of mobile revenues in total telecommunication revenues, 2010



Source: ITU.
Note: * Data from operators' annual reports. ** ITU estimate. # 2009 data. † Data based on ARPU and subscription quarterly figures published by TRAI.

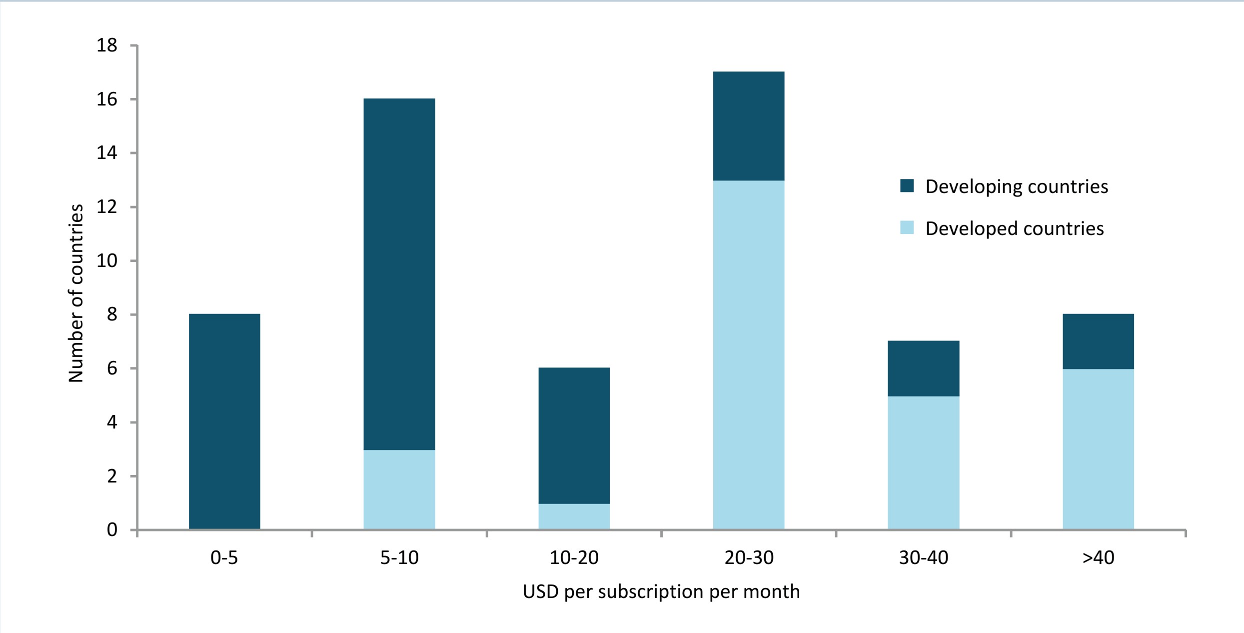
revenues. Of all developing countries for which revenue data are available for 2010, only in Colombia, the Republic of Korea[27] and Brazil[28] do mobile revenues account for less than 50 per cent of the total; whereas, in most developed countries, the mobile sector accounts for less than 50 per cent of total telecommunication revenues. This is in part explained by the high level of development of fixed-broadband markets and by the increase in bundled services.[29]

Data for the period 2007-2010 show that, in the majority of countries, the share of mobile in total telecommunication revenues increased over four years. This holds true for both developed and developing countries, and highlights the growing economic importance of mobile services. Some of the challenges that remain ahead if countries are to continue on this growth path include: (i) extending mobile-cellular services to unserved areas and populations, particularly in Africa, which by end 2011 still had a total penetration rate of below 60 per cent; (ii) fostering competition in 3G and more advanced services, in order to replicate the benefits competition has brought in traditional mobile-cellular services; (iii) moving forward with the deployment of advanced technologies, such as LTE, which will pave the way for future revenue growth; and (iv) accelerating the uptake of higher value revenue sources, such as mobile data, which is already becoming the main driving factor of revenue growth in developed countries.

Another useful measure of mobile revenues is the average revenue per subscription, usually referred as average revenue per user (ARPU). Available data show that average revenue per mobile subscription varies from some USD 60 per subscription per month in Canada to USD 2 in India and Pakistan. In general, developed countries have higher ARPU figures – USD 20 per month and above – while the majority of developing countries are in the lower range – below USD 10 per month (Chart 4.8). Kuwait and the United Arab Emirates are remarkable exceptions, both ranking in the top ten countries with the highest mobile ARPU (Table 4.5).

ARPU figures may be indicative of general price levels, with higher prices in USD terms explaining higher revenues per subscription. To a certain extent, this explains why ARPU figures are high in countries that have relatively high price levels in USD, such as for instance Canada, France and Switzerland, all of which are among the world's top ten most

Chart 4.8: Average mobile revenue per subscription, 2010, by level of development



Source: ITU.
Note: Data for Brazil, Kenya and Viet Nam refer to 2009. Data for all other countries included refer to 2010.

Table 4.5: Average revenue per mobile-cellular subscription, 2007-2010

	USD / subscription/ month			
Economy	2007	2008	2009	2010
Canada	56	57	52	61
United States	47	49	47	50
France	48	51	48	43
Norway	43	44	41	42
Israel	35	41	38	42
Kuwait*	60	65	45	42
Switzerland	41	44	38	41
Ireland	47	50	45	40
Greece	43	40	37	38
United Arab Emirates	39	42	38	38
Netherlands	26	39	38	37
Belgium	44	44	40	36
Denmark	42	42	38	36
Korea (Rep.)	40	35	30	32
Spain	35	37	33	30
Iceland	65	45	31	30
Finland	42	36	32	28
United Kingdom	41	38	30	28
Austria	40	37	32	28
Germany	31	29	28	27
Sweden	23	26	23	27
Slovenia	28	31	29	27
Czech Republic	24	42	25	25
Slovakia	22	32	29	24
Venezuela	20	21	24	23
Portugal	25	24	27	23
Malaysia	19	22	20	22
Italy	31	25	23	21
Oman	30	27	22	21
South Africa*	21	18	18	20
Estonia	30	31	28	20
Saudi Arabia	27	23	19	19
Brazil	19	21	17	N/A
Mexico	18	17	15	16
Turkey	13	12	11	12
Poland	N/A	14	11	11
Argentina	12	11	*9*	*10*
Colombia	10	9	8	9
China	8	9	9	9
Morocco	11	11	10	8
Algeria	8	10	8	*8*
Kazakhstan	7	10	8	8
Thailand*	8	8	7	7
Senegal	14	12	8	7
Russian Federation	9	9	6	7
Peru	N/A	7	6	7
Georgia	14	17	14	6
Panama	10	10	7	6
Nigeria	10	9	7	6
Belarus	9	9	7	6
Egypt	8	8	6	5
Ghana	N/A	8	6	5
Kenya	6	5	5	N/A
Ukraine*	6	7	4	4
Philippines*	N/A	4	4	4
Uzbekistan*	5	5	4	3
Indonesia*	6	4	4	3
Viet Nam	4	4	3	N/A
Pakistan	3	2	2	2
India†	5	4	3	2

Source: ITU.
Note: Data in italics are ITU estimates. * Data from operators' annual reports. Figures for China (2010) and Kazakhstan (2008) represent also data collected from the main operators. † Data based on ARPU and subscription quarterly figures published by TRAI.

expensive mobile-cellular sub-baskets in USD (see Chapter 3) and which display some of the highest ARPU values.

The relation between ARPU and price levels further suggests that overall mobile-cellular prices in the world are decreasing, since in most countries ARPU figures have gone down between 2007 and 2010. This means that subscriptions are growing at a faster pace than revenues. In developing countries, this may be due to the extension of mobile-cellular services to low-usage customers, who have lower spending capacity but are very relevant insofar as they represent a large proportion of the total population in some countries. For instance, the four countries that added most mobile-cellular subscriptions in the period 2007-2010 are India, China, Indonesia and Brazil, and they would certainly not have seen the same growth if low-end users had not been targeted. In developed countries, decreasing ARPU figures are the natural consequence of markets that are reaching saturation levels in terms of mobile-cellular subscriptions. Moreover, operators are facing an increasingly competitive environment, with the emergence of new market players such as mobile virtual network operators, mobile number portability, reduced MTRs, etc. This explains the pressure on prices and the reduction in ARPU.

ARPU may also be indicative of the type of subscriptions. For instance, in India each postpaid subscription generates more than six times as much revenue as a prepaid subscription (Telecom Regulatory Authority of India, 2012). This is another factor that explains why ARPU figures are higher in developed than in developing countries.

ARPU data may also provide information on the type of services used and the intensity of use. For example, a subscription involving only voice and sms services will usually generate less revenue than a subscription that also includes data services. This may explain some remarkable exceptions to the overall downward trend in ARPU. In countries such as Canada, Sweden, the United Arab Emirates or the United States, revenue per subscription was maintained or even increased in 2007-2010. This suggests that in these countries – which are among the most advanced in terms of deployment of new mobile technologies[30] – operators have succeeded in counterbalancing the competitive pressure on revenues from traditional mobile services with mobile data revenues.

The findings derived from ARPU figures highlight the importance of developing mobile services that generate higher revenues, such as those offered through postpaid subscriptions and mobile data services, particularly in a context of increasing saturation of traditional mobile markets in developed countries. Although developing countries still have room for revenue growth driven by traditional mobile-cellular services, the uptake of mobile services that yield higher revenues is also important (at least in some urban/high-income areas) if operators are to find the incentives to invest in the networks that will make advanced telecommunication services, such as mobile-broadband access, available to a majority of the population.

4.4 Investment in the telecommunication sector

Telecommunications is an infrastructure business and therefore requires significant capital investments, especially in comparison with other components of the ICT sector.[31] In telecommunication infrastructure, projects tend to be large-scale and require considerable initial capital outlays, with expected income flows spread over several years. They are also characterized by economies of scale and scope, and show some features of a natural monopoly – in the sense that the average cost of providing service declines with additional customers. A distinctive feature of telecommunications as compared with other infrastructure businesses is that the technology evolves very fast, and therefore telecommunication networks and services require a sustained flow of investment in order to keep up with technological evolution.

Prior to the wave of liberalization of telecommunication markets that started in the early 1990s, large (mostly public) investments were necessary for the deployment of the public switch telephone network, which still today constitutes the foundation on which most fixed-telephone services and xDSL access are based. Subsequently, later in the 1990s and in the early part of the new century, investment in mobile-cellular networks underpinned the developments that led to the mobile miracle, with the private sector playing a significant role in this wave of investment. In parallel with investment in the access

network (i.e. the last mile that reaches the subscriber), other investments have been made in order to build and update the intricate mesh of interconnected networks, including the backbone infrastructure. The progress seen in recent years in the uptake of ICT services (see Chapter 1) would not have been possible without the prior investment in networks extending their reach to a larger share of the world's population.

Today, fixed networks are undergoing an important transition to next-generation networks (NGN) in order to meet the requirements of advanced ICT services, such as bandwidth-hungry applications and convergent services.[32] This calls for substantial investment in fixed networks in order to keep pace with the innovative ICT services that drive uptake. At the same time, mobile networks are also evolving to cater for the growing demand for mobile-broadband services. This calls for major investments in order to progress from 3G technologies to long-term evolution (LTE) and other advanced wireless-broadband technologies, such as those based on WiMAX. These investments in wired and wireless networks are necessary not only to improve the services currently provided, but also to bring them to more people. This is particularly true in the developing world, where the deployment of advanced wireless-broadband networks, for example, has the potential to extend broadband access to previously unconnected populations (Box 4.3).

This section examines investment in telecommunication services from two complementary perspectives, namely capital expenditure (CAPEX) and foreign direct investment (FDI). CAPEX data show investments in fixed assets, which best reflect the roll-out of new infrastructure. Capital expenditure (also referred to here as investment in telecommunications) is aggregated by country, irrespective of whether the investments originate from a domestic or an international source, or whether they come from public or private sources. FDI data serve to analyse the role of cross-border financing and business internationalization in the telecommunication industry. FDI is broader than investment in fixed assets, and therefore is not directly comparable with CAPEX. For instance, the privatization of a telecommunication operator would fall under FDI if a foreign-based company acquires 10 per cent or more voting power in the privatized entity. However, this cross-border transaction would not necessarily imply any new investment in fixed assets, since the privatized operator might continue with the same infrastructure and installations as before the foreign acquisition. Both CAPEX and FDI data provide valuable information on the current situation and the evolution of investment in telecommunications.

Capital expenditure in telecommunications

Data on capital expenditure in telecommunications refer to investments for acquiring or upgrading property and networks made by all businesses providing public telecommunication services.[40] Not all CAPEX refers to investment in telecommunication networks. For instance, the acquisition of a building or computer software by a telecommunication operator is also considered as capital expenditure. However, CAPEX is a good measure of the investment in fixed assets necessary to support the growth in telecommunication services within a given economy. It is thus an indication of the intensity of telecommunication investment irrespective of the source (foreign or domestic; public or private).

CAPEX data need to be analysed with caution, insofar as the impact of an investment may extend beyond its particular year of allocation. For example, the benefits of investing in a new LTE network will accrue over several years. Even if deployments are gradual, the uptake of new services in a given area where they have become available will most likely happen progressively over time. Therefore, current CAPEX to a certain extent determines future rather than current ICT developments.

In the period 2007-2010, telecommunication CAPEX rose by 20 per cent in developing countries, while in developed countries it fell by 5 per cent (Chart 4.9). As a result, the world's total telecommunication CAPEX grew only by a moderate 4 per cent in the four-year period.

Capital expenditure increased strongly between 2007 and 2008 in both developed and developing countries, attaining a total value of USD 276 billion in 2008. The increase was reversed in the following years, coinciding with the financial crisis, and CAPEX declined to USD 241 billion in 2010. This is consistent with an economic context

Box 4.3: Investment in LTE – developing countries are catching up

The current surge in mobile-broadband uptake[33] would not be possible without the prior assignment of spectrum and the significant investments made worldwide in 3G networks. This highlights the importance of regulatory decisions, such as the award of new licences, in unlocking investment and laying the foundations for future growth.

The first 3G licences were awarded in 2000 in Japan and the Republic of Korea, with commercial services launched in 2001.[34] Several developed countries soon followed suit, after the UMTS auctions that took place in 2000 and 2001 in Europe[35] and the launch of commercial 3G services in the United States in 2002.[36] In most developing countries, on the other hand, 3G licences were not granted until much later.[37] In large emerging countries such as China and India, for instance, 3G licences were awarded in 2009 and 2010 respectively,[38] i.e. almost ten years later.

As at mid-2011, ITU estimates the population coverage of 3G networks to be nearly 80 per cent in developed countries, and below 40 per cent in developing countries. This difference is explained to some extent by the late spectrum assignments and the consequent delay in network investment in several developing countries.

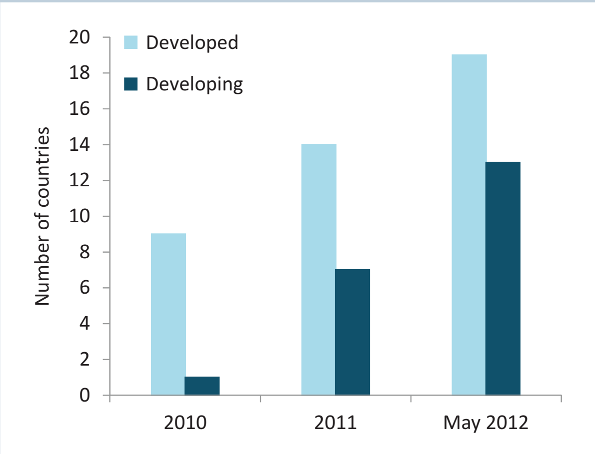
In the current situation of growing demand for mobile-broadband services, investments in mobile networks in developed countries are targeting advanced wireless-broadband technologies, such as LTE. In the case of developing countries, part of the investment in mobile networks is still allocated to extending the coverage of 3G networks, which remains limited. In Brazil, for example, the population coverage of 3G networks was increased from 55 to 67 per cent between 2009 and 2010. Brazilian operators are progressively extending 3G coverage to more localities, particularly in sparsely populated regions, such as the north and the north-east of the country (See Box 2.2, Chapter 2).[39]

Unlike in the initial phase of 3G network deployments, however, investment in LTE networks and commercial launches are not entirely confined to developed countries. A number of operators from developing countries are also starting to deploy LTE networks (Chart Box 4.3). For instance, in the Arab States, Bahrain, Kuwait, Saudi Arabia and the United Arab Emirates had commercially active LTE networks by May 2012. In Africa, Angola and Namibia saw the commercial launch of the first LTE networks in the region in April and May 2012, albeit with very limited coverage. In Asia and the Pacific, operators from the Philippines and India also launched commercial LTE networks, although here again restricted to a few sites.

Early launch of LTE networks has been possible because in most cases operators have taken advantage of technology-neutral licences to deploy LTE, without the need for new spectrum auctions.

The fact that some operators from developing countries are already investing in what is poised to be the next major revolution in mobile networks is a good sign for the future of mobile broadband in the developing world. Indeed, this time developing countries are taking part in the early stage of deployment of new technologies.

Chart Box 4.3: Commercial LTE deployments, 2010-2012, by level of development

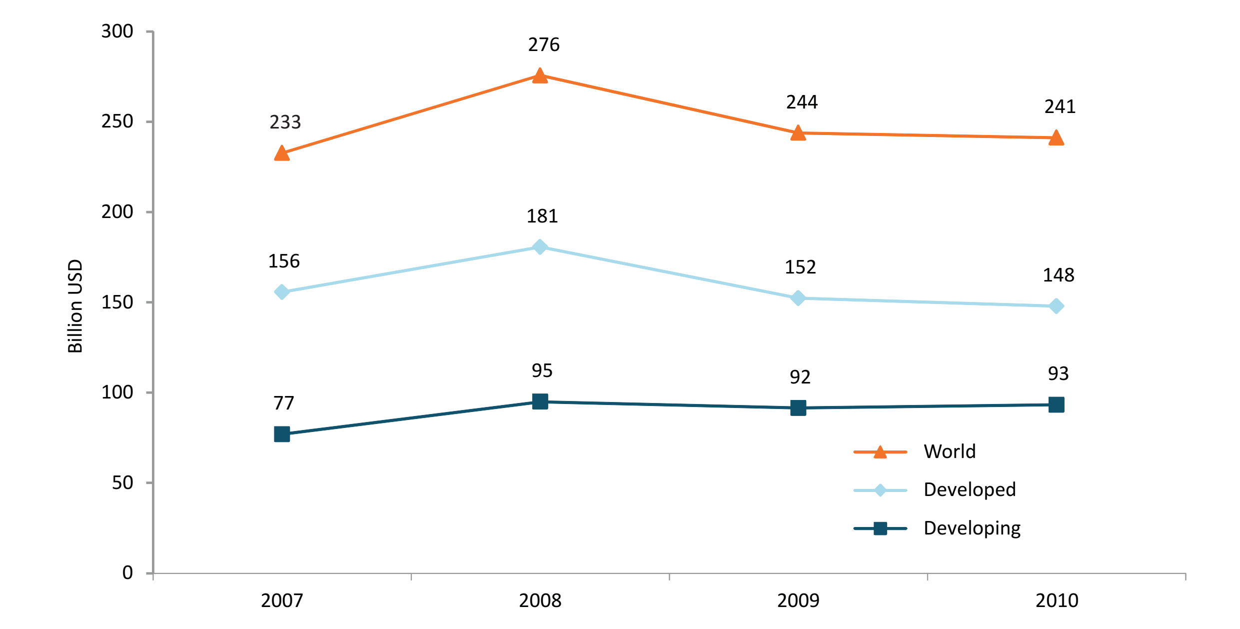


Source: ITU and LteMaps (ltemaps.org).
Note: The chart reflects the number of countries that have launched LTE commercially. It does not reflect LTE coverage, which varies greatly between countries.

of restricted access to capital markets, which may limit the capacity of telecommunication operators to raise funds for new investments.

The decline in telecommunication CAPEX was particularly apparent in developed countries, which experienced an 18 per cent decrease from 2008 to 2010. In developing

Chart 4.9: Total telecommunication investment, 2007-2010, world and by level of development



Source: ITU.
Note: Refers to data on capital expenditure (CAPEX). 'World' includes 46 countries accounting for 84 per cent of world GDP. 'Developed' includes 25 developed countries accounting for 88 per cent of total GDP in the developed world. 'Developing' includes 21 developing countries accounting for 75 per cent of total GDP in the developing world.

countries, on the other hand, the decrease in the same period was much lower (2 per cent), although absolute levels of investment in telecommunications remained significantly below those of developed countries. Overall, in the period 2007-2010, capital expenditure in telecommunications followed a similar pattern to total revenues of the sector (Chart 4.4).

The list of top ten countries in terms of telecommunication investment closely matches the list of main markets in terms of telecommunication revenues. Large markets such as the United States, China, Japan and Brazil concentrate most telecommunication investment, accounting for half of the world's total CAPEX in telecommunications in 2010 (Table 4.6).

India stands out as the country with the fourth highest investment in telecommunications (USD 13 billion)[41] while ranking only 14th in terms of telecommunication revenues (USD 36 billion). Thus, the country had the highest investment-to-revenue ratio among the large telecommunication markets. India experienced enormous subscription growth in the period 2007-2010, adding more than 500 million mobile-cellular subscriptions and nearly 8 million fixed-broadband subscriptions. This expansion of the subscriber base (which is still far from reaching saturation levels) was partly possible because of the investment made by operators to reach rural areas. Mobile-cellular subscriptions in rural areas increased at a CAGR of about 70 per cent in 2007-2010, hitting the 250 million landmark in 2010. Moreover, in 2009 the two government-owned operators BSNL and MTNL launched 3G services, albeit with limited population coverage. Since private operators received 3G licences in 2010, CAPEX in these new networks is likely to maintain the investment flow in the coming years.

Data on telecommunication CAPEX in local currency show that the majority of developing countries increased investment in telecommunications from 2007 to 2010.[42] Examples of developing countries displaying strong and sustained growth in telecommunication investment include Argentina, Egypt (Box 4.4) and Senegal, all with a CAGR above 10 per cent during this time-frame.

Table 4.6: Investment in telecommunications, 2007-2010, by country, millions

	2007	2008	2009	2010	
Economy	Local currency	Local currency	Local currency	Local currency	USD
United States	61’407	80’651	67’262	70’149	**70’149**
China*	201’143	230’492	242’294	232’549	**34’350**
Japan	2’427’065	2’434’018	2’369’423	1’486’634	**16’936**
India*	542’124	608’347	658’939	606’999	**13’275**
Brazil	15’139	26’798	21’486	*20’196*	***11’481***
France	6’140	6’529	5’965	6’400	**8’477**
Canada	7’800	12’000	8’000	8’400	**8’155**
Italy	7’163	6’689	6’222	6’156	**8’154**
Germany	7’100	7’200	6’000	5’900	**7’815**
Russian Federation	310’400	234’157	147’893	192’066	**6’325**
Mexico	35’768	40’604	36’777	71’453	**5’655**
Korea (Rep.)	6’356’700	6’891’600	6’514’100	6’401’200	**5’537**
Spain	5’788	4’765	3’954	4’095	**5’424**
Egypt	12’760	14’871	17’283	19’884	**3’537**
Colombia*	1’802’744	2’614’706	2’128’651	4’759’431	**2’507**
Turkey	2’479	3’761	6’383	3’761	**2’502**
Indonesia*	33’502’500	41’595’600	34’797’100	22’716’800	**2’499**
Netherlands	1’632	1’976	1’684	1’874	**2’482**
United Arab Emirates	7’902	8’248	9’544	7’861	**2’140**
Switzerland	2’762	2’278	2’292	2’178	**2’088**
South Africa*	13’889	16’217	14’646	13’310	**1’818**
Argentina*	4’375	5’347	*5’953*	7’017	**1’801**
Malaysia	4’270	4’483	5’280	*5’585*	***1’734***
Belgium	1’167	1’123	1’155	1’265	**1’676**
Greece	1’294	1’371	1’347	1’088	**1’441**
Portugal	1’315	1’000	1’054	1077	**1’427**
Venezuela	3’621	3’042	3’392	3’683	**1’424**
Denmark	9’141	9’627	8’333	7’116	**1’265**
Sweden	10’698	9’689	9’101	7’022	**974**
Austria	878	713	518	674	**893**
Finland	436	437	580	630	**834**
Czech Republic	16’153	14’879	14’546	14’970	**784**
Peru	*2’064*	2’573	2’328	2’155	**763**
Morocco	5’270	7’068	6’590	6’026	**716**
Hungary	89’746	162’388	192’485	140’616	**676**
Ireland	458	516	442	443	**587**
Belarus	1’039’200	1’023’200	1’140’200	1’464’267	**492**
Slovakia	13’096	405	391	359	**476**
Oman	67	155	138	171	**445**
Senegal	99’000	119’000	125’000	162’000	**327**
Slovenia	325	283	181	150	**199**
Costa Rica*	42’753	76’585	99’104	98’360	**187**
Panama*	103	83	94	106	**106**
Estonia	1’481	1’495	1’025	1’078	**91**
Iceland	8’483	8’303	4’296	5’264	**43**

Source: ITU World Telecommunication/ICT Indicators database.
Note: Refers to data on capital expenditure (CAPEX). Data in italics are ITU estimates. * Data from operators’ annual reports.

The relative value of investment can be measured by the ratio of capital expenditure to total revenues in telecommunications. A lower value indicates that investment represents a small share of total revenues, while a high value suggests that a significant proportion of the revenues generated are reinvested.

The investment-to-telecommunication revenues ratio varies from 65 per cent in Ghana to about 9 per cent in the United Kingdom (Chart 4.10). Values in developed countries are in most cases below 20 per cent, while in several developing countries they are above that level. This suggests that the

Box 4.4: Competition as a driver of investment – the case of Egypt

In Egypt, capital expenditure in telecommunications increased at a rate of 16 per cent annually (CAGR) between 2007 and 2010, to almost EGP 20 billion. This came about as a result of increased competition in mobile-cellular telephony, with Etisalat Misr, the third operator, entering the market in 2007. Similarly, access to mobile broadband was boosted by competition in 3G services, with licences awarded and services launched in 2007-2008 by the three operators: Etisalat Misr, Vodafone Egypt and ECMS Mobinil (ITU,2012).

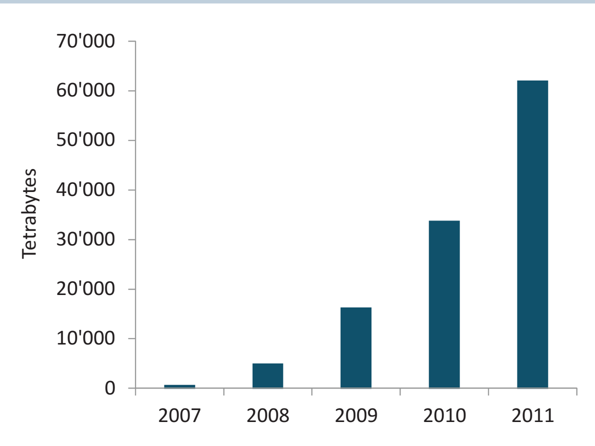
By 2010, the total number of active mobile-broadband Internet subscriptions had already reached 5 155 000,[43] in a country with a total population of 80 million. Etisalat Misr invested EGP 8 billion (USD 1.4 billion) between 2007 and 2010, and it plans to sustain the same investment efforts for 2011-2013, identifying network expansion as a priority.[44] To encourage the roll-out of state-of-the-art communication services, the National Telecommunications Regulatory Authority (NTRA) invited bids and issued two triple-pay licences in October 2009.[45] In the same year, the monopoly fixed-line incumbent operator, Telecom Egypt, initiated an important infrastructure development project to deploy FTTH in selected suburbs of Cairo for high-speed broadband access, as part of a triple-play service (voice, data and IPTV) targeting high-income and business customers.[46]

Investments are expected to continue, notably following the implementation of NTRA's eMisr National Broadband Plan, launched in November 2011 to support the expansion of broadband in the country, including to rural areas.[47]

Box 4.5: Fostering public and private investment in telecommunication – the case of Finland

The Finnish government has been very active in promoting investment in new broadband networks. For instance, the 'Broadband 2015' plan was launched in December 2008 with the aim of rolling out superfast broadband networks to sparsely populated areas of the country. For each project, the state and municipalities subsidize a part of the roll-out, while telecommunication companies are responsible for carrying it out and providing the remaining funding (FICORA, 2011).

Chart Box 4.5: Data transferred in mobile networks, 2007-2011, Finland

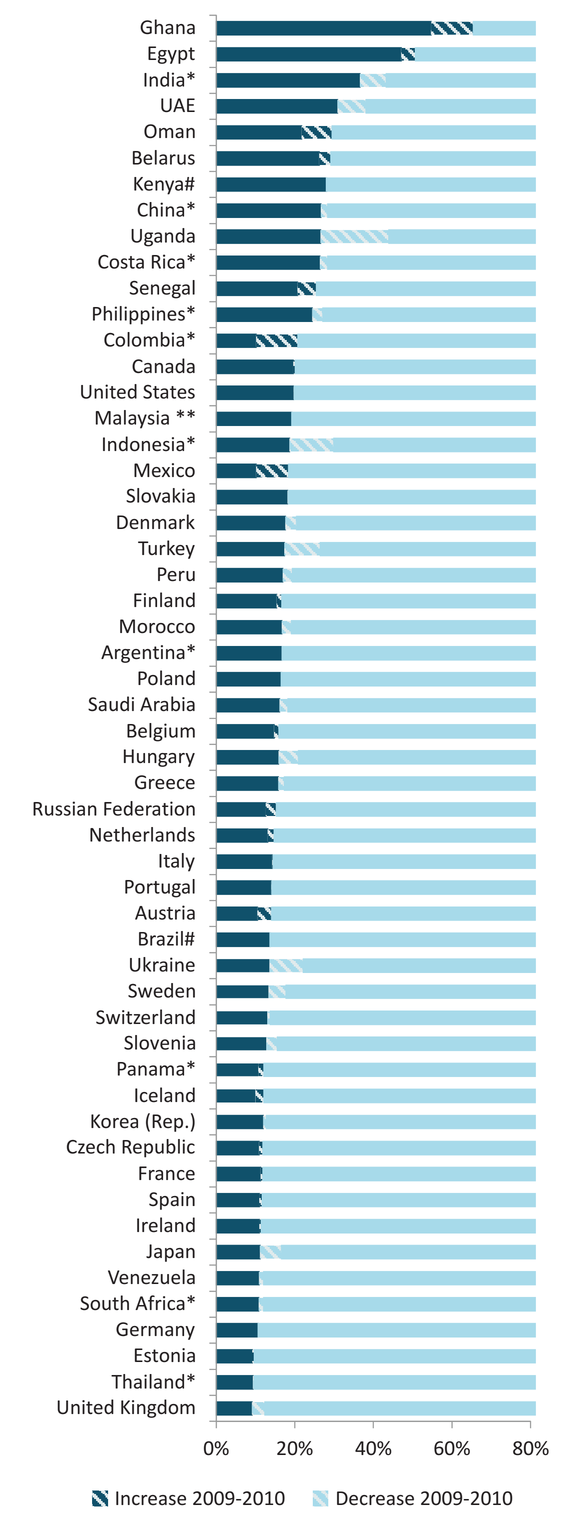


Source: FICORA.

Finnish mobile operators have also been investing in the roll-out of advanced wireless-broadband networks based on LTE and WiMAX technologies, some of which came into operation as early as end 2010. These investments in new telecommunication networks have had a marked effect on broadband uptake and intensity of use in Finland. For instance, fixed (wired)-broadband subscriptions had been decreasing since 2007, but regained growth in the second half of 2010 and continued to increase in 2011. The volume of data traffic in mobile networks increased exponentially between 2007 and 2011 (Chart Box 4.5). This highlights the importance of investment in advanced broadband networks for sustaining future subscription and usage growth.

most advanced countries in terms of ICT developments require relatively low investments in relation to the revenues generated by telecommunication services, while those that are at an earlier stage of ICT development need high

Chart 4.10: Ratio of telecommunication capital expenditure (CAPEX) to total telecommunication revenues, 2010



Source: ITU.
Note: * Data from operators' annual reports. ** ITU estimate. # 2009 data.

investments in relative terms. This may be explained by the fact that in most developed countries telecommunication markets have reached maturity in terms of uptake and use, and therefore also in terms of revenue generation. In developing countries, particularly those that are at a stage of high growth, the telecommunication market is still relatively small in terms of revenues, but significant investments are needed to fuel ICT growth.

To illustrate this, Ghana, Egypt, and India – which are the countries with the highest investment-to-revenue ratio – have recently experienced high growth in mobile-cellular services: between 20 and 30 new subscriptions per 100 inhabitants were added between 2009 and 2011. This called for relatively high levels of investment to bring mobile-cellular services within the reach of a larger proportion of the population. On the other hand, the United Kingdom – the country with the lowest investment-to-revenue ratio – saw nearly no growth in mobile-cellular subscriptions between 2009 and 2011. Investments were instead targeted at other areas offering higher value added, such as fixed- and mobile-broadband deployments. Moreover, the United Kingdom is the seventh biggest telecommunication market in the world in terms of revenues, nearly twice as large as India, nine times Egypt and more than 50 times Ghana. Therefore, new investments represent a much lower share of total revenues.

Comparing telecommunication CAPEX with total capital expenditure in the economy as a whole (measured by gross fixed capital formation) provides information on the intensity of investment in telecommunication services relative to investment in other sectors. During the years 2007-2010, telecommunication CAPEX represented on average only a modest 2.8 per cent of total GFCF. The ratio varied between countries, with developing economies generally displaying a higher share of investment in telecommunications (3.7 per cent on average), particularly in Africa and the Arab States. Telecommunication investment had a greater weight (above 8 per cent) in a number of African countries, such as Ghana, Kenya, Senegal and Uganda, testifying to the importance of telecommunications as an area of investment in these economies (Table 4.7). In European countries, telecommunications represented the lowest share in gross fixed capital formation, a generally steady 1.5 per cent. The share of telecommunication services in investment exceeded the 2.8 per cent world average in the United States

Table 4.7: Annual capital expenditure in telecommunication services as a percentage of total gross fixed capital formation, 2007-2010

Economy	2007	2008	2009	2010	Average (2007-2010)
Ghana	N/A	N/A	12.5	12.7	12.6
Kenya	11.9	12.6	8.8	N/A	11.1
Senegal	7.0	7.4	8.8	10.7	8.5
Egypt	8.2	7.4	8.6	N/A	8.1
Uganda	N/A	11.5	7.8	5.0	8.1
United Arab Emirates	5.3	N/A	N/A	N/A	5.3
Ukraine	N/A	4.3	5.6	3.0	4.3
Philippines*	N/A	N/A	4.1	3.0	3.6
Brazil	3.3	4.6	3.7	2.8	3.6
Malaysia	3.1	3.1	3.8	*3.6*	3.4
India*	3.3	3.3	3.2	2.6	3.1
Portugal	3.5	2.6	3.0	3.2	3.1
Pakistan	4.5	4.2	1.8	1.6	3.0
South Africa*	3.4	3.1	2.8	2.6	3.0
Morocco	2.7	3.1	2.9	N/A	2.9
Saudi Arabia	N/A	3.0	2.9	2.8	2.9
United States	2.3	3.1	3.0	3.1	2.9
Hungary	1.6	2.8	3.6	2.9	2.8
Greece	2.4	2.7	3.1	2.9	2.8
Slovakia	N/A	N/A	3.0	2.5	2.7
Russian Federation	4.4	2.5	1.7	2.0	2.7
Poland	N/A	2.6	2.8	2.6	2.7
Canada	2.3	3.3	2.4	2.4	2.6
Belarus	3.4	2.4	2.3	2.3	2.6
Slovenia	3.4	2.6	2.2	2.0	2.5
Denmark	2.5	2.6	2.7	2.4	2.5
Colombia*	1.9	2.4	1.9	4.0	2.5
Peru	*2.8*	*2.6*	2.7	2.0	2.5
Venezuela	3.0	2.2	2.2	2.1	2.4
Indonesia*	3.4	3.0	2.0	1.1	2.4
Iceland	2.3	2.3	2.1	2.7	2.3
Turkey	1.4	2.0	4.0	1.8	2.3
Argentina*	2.2	2.2	2.5	2.2	2.3
Costa Rica*	1.4	2.1	2.7	2.7	2.2
United Kingdom	N/A	2.4	2.6	1.6	2.2
Korea (Rep.)	2.3	2.3	2.1	1.9	2.1
Switzerland	2.5	2.0	2.1	1.9	2.1
Italy	2.1	2.0	2.1	2.0	2.1
Japan	2.1	2.1	2.4	1.5	2.0
Australia	2.2	1.8	N/A	1.9	2.0
Kazakhstan	2.2	N/A	1.5	N/A	1.8
Oman	1.4	2.3	N/A	N/A	1.8
Mexico	1.5	1.5	1.4	2.6	1.8
Panama*	2.3	1.4	1.6	N/A	1.7
Spain	1.8	1.5	1.6	1.7	1.6
China*	1.9	1.8	1.5	1.3	1.6
Ireland	0.9	1.3	1.8	2.5	1.6
France	1.6	1.6	1.6	1.7	1.6
Czech Republic	1.8	1.4	1.6	1.6	1.6
Belgium	1.6	1.5	1.6	1.8	1.6
Netherlands	1.4	1.6	1.5	1.7	1.6
Sweden	1.7	1.5	1.6	1.2	1.5
Germany	1.6	1.6	1.5	1.4	1.5
Finland	1.1	1.1	1.7	1.9	1.5
Austria	1.5	1.2	0.9	1.1	1.2
Norway	0.8	0.7	0.8	N/A	0.8

Source: ITU, IMF and OECD.
Note: Data in italics are ITU estimates. * Data from operators' annual reports. Data for OECD members were provided by OECD.

as well as in a number of emerging developing nations such as South Africa, the Philippines, Brazil, Malaysia and India.

Between 2007 and 2010, the trend in both telecommunication investment and gross fixed capital formation was generally positive in the majority of the developing countries for which data were available. Telecommunication investment outgrew gross fixed capital formation in several economies, such as three Latin American countries – Colombia, Costa Rica and Mexico – as well as Turkey and Senegal. Conversely, gross capital formation growth exceeded telecommunication investment growth in Belarus, China, Peru and Venezuela.

Over the same time period, telecommunication investment declined in Indonesia and the Russian Federation, in spite of a positive trend in total gross fixed capital formation in these countries.

In the economies affected by the 2008 global economic downturn, investment declined between 2007 and 2010, but the telecommunication sector was generally more resilient. In some of the countries with negative gross fixed capital formation rates, telecommunication investment was nevertheless sustained, partly as a result of stimulus measures to support economic growth.[50] This was the case in Finland, Hungary, Ireland and the United States.

Foreign direct investment in telecommunications

Foreign direct investment (FDI) is a particular category of cross-border capital movement, motivated by the establishment of a long-term strategic relationship between the investor and the enterprise invested in, where the investor acquires a significant degree of influence in the management of the enterprise. FDI transactions can result either in the purchase of existing assets, commonly referred to as mergers and acquisitions (M&A), or in the creation of new productive assets, known as greenfield investments. Direct investment transactions can be financed by equity (such as the acquisition of shares), debt (such as through contracting loans) or reinvesting earnings (OECD, 2008 and IMF, 2009).

Foreign investment statistics are a measure of businesses' internationalization. They help understand, from a macroeconomic point of view, the stocks and flows of financing between resident and non-resident enterprises. Given that policy-makers are increasingly interested in both attracting and making the most of international investments, demand for such statistics is rising.

There are three different statistical accounts related to FDI (OECD, 2008):

- Investment positions (or *stocks*), which are used to assess the structural composition of FDI by economic activity and origin of funds.[51]

- Direct investment *flows*, which reflect changes in a country's/economic sector's relative attractiveness for foreign investors, changes in the extent of globalization of its markets and its relative dependence on financing from abroad.

- Direct investment *income*, which is a short-term measure of earnings from the foreign investment activity, including dividends, interest and reinvested earnings.

From a policy perspective, FDI matters as it is an important source of capital, a possible means of technology transfer and upgrading, and an influencing factor in developing domestic labour and financial capital markets (UNCTAD, 2008). In particular, FDI in telecommunications has an important strategic role, as it can underpin economic development not only in the sector itself, but also in the other economic sectors which rely on ICT infrastructure.

In telecommunications, FDI is the principal mode of providing services abroad, unlike in other ICT industries where cross-border exports have a more prominent role. Foreign companies typically establish presence abroad as a means of gaining access to new customers in foreign markets. In return, these companies invest to develop the telecommunication infrastructure and to bring about the technical upgrades necessary to meet demand. Large multinational enterprises are dominant players in telecommunication FDI because they are more able to secure the long-term capital needed for investment in infrastructure, by leveraging international capital markets. Increased price competition, convergence towards multiple-play and the need for sustained investment capital

have also influenced the emergence of large regional and international telecommunication operators.

Privatization and stronger competition in telecommunications bring a host of additional benefits, besides the inflow of capital.[52] They serve to improve reliability and quality of service, they lead to price reductions and rapid mobile-cellular phone penetration, and they help to extend network coverage and access to lower-income consumers and rural areas. There is evidence that, after privatization, incumbents registered improvements in labour productivity, in delivery costs and times and in quality standards.[53] Along with the benefits also come a series of new challenges. For example, at times, foreign telecommunication providers have established strong market positions, challenging national regulators to revise their competition policies.

Another challenge for economic development strategies has been how to harness the benefits of investment in telecommunications, also in the sense of supporting domestic business development on the back of improved infrastructure.

In spite of the tremendous success achieved in securing private and foreign financing for telecommunication infrastructure, more investment is needed to achieve the goals of extending ICT access to all. Financing is required for extending network coverage to underserved rural areas in particular, and for upgrading networks to support quality broadband services (see Box 4.3).

Box 4.6 provides a summary of current work on measuring FDI in telecommunications.

Box 4.6: Defining and measuring FDI in telecommunications

ITU collects data from national telecommunication regulatory authorities or ministries on annual FDI inflows in respect of telecommunication services, covering fixed and mobile telephony and Internet services. The definitions and concepts, as presented in the ITU Handbook for the Collection of Administrative Data on Telecommunications/ICT (ITU, 2011a), are based on the general definition and methodology developed in the OECD Benchmark Definition of Foreign Direct Investment (OECD, 2008) and the IMF Balance of Payments and International Investment Position Manual (IMF, 2009). The focus is on foreign investment in enterprises resident in the reporting country whose main identified economic activity is to provide telecommunication services. According to IMF (2009), direct investment refers to "relationships when the direct investor owns equity that entitles it to 10 per cent or more of the voting power in the direct investment enterprise". This is also the definition applied by ITU.

There are several difficulties with collecting FDI data, not least for reasons related to ensuring international comparability and compliance of the reporting units with international statistical standards. FDI data collected by national statistical offices are generally based on enterprise surveys and/or economic censuses. Business registers, particularly in developing countries, are often not designed to identify enterprises in a direct foreign investment relationship (IMF, 2008). In addition, FDI statistics typically undergo revisions because they are often based on estimates formulated before enterprises publish their accounts at the end of each financial year (OECD, 2008). The current investment environment, in the aftermath of the 2008 global economic crisis, poses additional challenges for FDI data collection. These include: the volatility of exchange rates, the increasing sophistication of FDI-related transactions (e.g. packages that include private, public and development assistance funds); and the changing nature of transactions (e.g. investment through exchange of shares) (UNCTAD, 2011b).

Relatively few developing countries publish FDI data disaggregated by main sectors of economic activity, and, when they do, information pertaining to telecommunications may be lumped together with other sectors, such as transport and posts. Collecting FDI data on telecommunications should be made easier by the fact that the number of resident service providers is small and their identity is known to regulatory authorities. Challenges arise when operators do not publish financial information or when they publish regional rather than national data. In addition, data compilers should follow the criteria established in the Framework for Direct Investment Relationships for identifying both immediate direct investment and indirect

Box 4.6: Defining and measuring FDI in telecommunications (continued)

direct investment, which may take place through a chain of direct investment relationships. This includes "investment between enterprises that do not control or influence each other, but are both under the control or influence of the same investor" (IMF, 2009, p.101).

To provide a complete analysis, FDI data should ideally be available by economic sector (using the International Standard Industrial Classification, ISIC Rev.4), by partner country, by mode of investment (M&A or greenfield) and by main type of financing (equity, debt or reinvested earnings), while identifying separately flows, stocks and income.

This chapter uses a constructed dataset on FDI in telecommunications, bringing together data collected through similar methodologies by UNCTAD, OECD and ITU, for the period 2007-2010. The dataset captures foreign investment in a maximum of 76 economies, representing 85 per cent of 2010 global GDP, but there are important data gaps, particularly for more recent years. For the telecommunication sector, more countries report data on FDI inflows than outflows. In comparison with FDI flows, fewer developing countries report data on foreign investment stocks in telecommunications.

In addition, data from the World Bank Private Participation in Infrastructure (PPI) database were also used to show both historical trends in investment commitments in telecommunication infrastructure[54] and the composition of these commitments by geographical region and by type of project. PPI data are not directly comparable with either FDI or CAPEX. PPI data measure private investment commitments contracted in large telecommunication infrastructure projects in low- and middle-income countries.[55] Data refer to contractual investment commitments for projects and thus do not reflect actual annual investments. The projects covered[56] also include, in addition to foreign investment commitments, domestic private capital participation as well as public-sector funding (in the case of joint public-private initiatives) and payments to the government (such as licence fees). In comparison, FDI can contain additional data elements, related to cross-border financial transfers but not necessarily to private investment commitments, such as reinvested earnings from profits and pure consolidation M&As, where capital changes ownership.

Given the limited availability of data on FDI in telecommunications, more work is needed both on the side of international organizations in terms of harmonizing definitions and on the side of national data collection agencies, especially in developing countries, in terms of collecting comparable data.

Source: Based on ITU (2011a), OECD (2008), IMF (2009) and UNCTAD (2011b).

Two decades of private investment commitments in telecommunication infrastructure

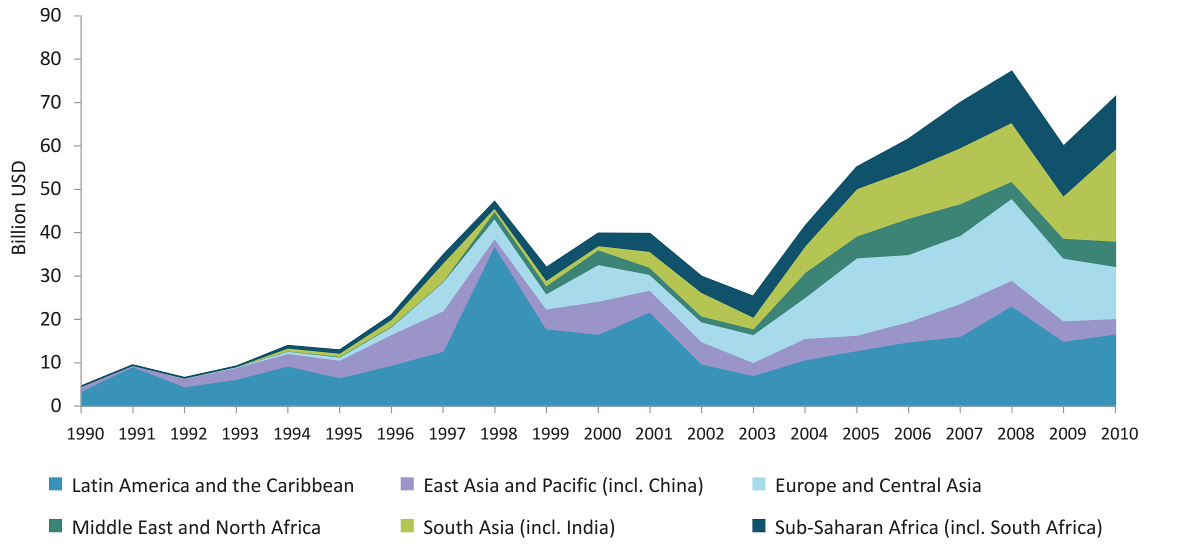
Historically, lack of financing capital significantly hindered development of the telecommunication sector, especially in lower-income countries. Limited investment meant that access to and use of the telecommunication infrastructure was also limited, especially in markets where both public and private capital were scarce and the opportunity cost of investing public money was high.

In the last two decades, private capital has grown to become a leading contributor (albeit not the only one) to telecommunication development, underpinning a rapid improvement in network coverage and subscription rates. These developments have been achieved through successive waves of liberalization, beginning in the early 1990s with the first wave of liberalization and opening up of developing-country telecommunication markets to foreign investment, particularly in Latin America (Chart 4.11 top). At the time, many Latin American and African countries were heavily indebted and were seeking alternatives to public financing (UNCTAD, 2008). Foreign invested affiliates of transnational corporations were better able to mobilize financial resources from international or regional capital markets. They also brought along their experience and technological capital.

After the turn of the century, investment commitments picked up significantly in South Asia and Africa. The years 2005-2007

marked a period of high growth in investment commitments in both the Middle East and North Africa and in Europe and Central Asia. Over the last decade, it has been the private sector which, through investment, has made much of the mobile revolution possible, bringing about a rapid increase in the number of mobile-cellular subscriptions, including in many lower-income countries. In this context, foreign investment has played an important role in ensuring the roll-out of telecommunication infrastructure in developing countries (ITU, 2009b and UNCTAD, 2008). LDCs in particular have benefited from high levels of investment commitments in telecommunications during the last decade, while their efforts to secure private investment in other infrastructure have often not proven equally successful. LDC telecommunication investments have been sponsored by

Chart 4.11: Investment commitments in telecommunication projects with private participation, in low- and middle-income countries, 1990-2010, by regional group (top) and by mode of financing (bottom)





Note: Regional groups are based on the World Bank classification.
Source: World Bank PPI database.

capital from both developed and developing countries, with more than 40 per cent participation from the latter.

Generally, the telecommunication sector stands out among the various infrastructure sectors in terms of the particularly high share of private investment commitments dedicated to the creation of new productive assets (greenfield investments).[57] Over the last two decades, almost 60 per cent of private investment commitments in telecommunication infrastructure have been greenfield projects (Chart 4.11 bottom). However, there were considerable differences between countries, reflecting different policies for attracting FDI in this field. For example, the proportion of greenfield projects was very high in India, Nigeria, Thailand and the Philippines. In countries such as Brazil, China and Peru, on the other hand, privatizations accounted for most of the value of private investment commitments.

Looking at the cumulative value of private investment commitments in telecommunications over the last 20 years, the main recipients have been large emerging economies such as Brazil, India, Mexico and the Russian Federation (Table 4.8). These economies typically succeeded in attracting private investment not only in telecommunications, but also in the other infrastructure sectors, such as transportation and water and sanitation.

In many other low-income and middle-income economies, telecommunications consistently accounted for a high share of total private investment commitments in infrastructure. More than two-thirds of private projects in South Africa, Nigeria, Egypt and Venezuela were devoted to telecommunication infrastructure (Table 4.8).

The role of investment in telecommunications for smaller economies should not be understated. Even if in absolute terms the numbers do not capture the imagination, telecommunications accounted for the majority of total private infrastructure commitments in several low-income countries, for example in Africa (Box 4.7).

Table 4.8: Top 20 low-income and middle-income economies, by cumulative value of private-sector investment commitments in telecommunications, 1990-2010

Economy	Cumulative commitments in telecommunications, 1990-2010 (million USD)	Share of greenfield projects in telecommunications (%)	Share of telecommunications in total private infrastructure commitments (%)	Telecommunication investment commitments, 2010 (million USD)
Brazil	127'876	25.8	42.9	8'942
India	81'196	96.0	31.8	20'335
Mexico	61'646	42.6	58.9	3'668
Russian Federation	59'121	71.3	54.4	6'314
Argentina	31'608	37.1	37.6	960
Turkey	29'884	59.5	48.3	1'683
Indonesia	27'913	38.2	55.9	1'108
South Africa	25'855	57.8	79.1	2'101
Nigeria	21'403	96.5	80.5	3'036
Thailand	16'650	100.0	41.5	420
Egypt	16'363	65.0	78.2	2'113
Pakistan	16'258	67.5	57.0	271
Philippines	16'099	94.3	30.2	995
Venezuela	14'942	36.4	96.2	423
China	14'518	0.0	12.7	0
Peru	11'852	23.8	46.6	548
Malaysia	11'791	73.0	22.1	947
Morocco	11'053	32.1	53.2	1'124
Romania	10'981	69.2	58.1	680
Colombia	10'658	83.0	38.0	1'053

Source: World Bank PPI database.

Box 4.7: Africa and FDI in telecommunications

Africa became the textbook case study to illustrate the benefits of private investment in telecommunications, following the liberalization[58] of the sector at the end of the 1990s, and resulting in the rapid expansion of mobile telephony in the region. Telecommunications accounted for a very high share of total private investment commitments in infrastructure in the countries concerned (Table Box 4.7). In a large majority of cases, commitments involved greenfield investment projects, which helped build up the mobile-telephone infrastructure. Investment stemmed to a large extent from developing countries such as Egypt, Kuwait, South Africa and the United Arab Emirates, with a more than half contribution from African investors, more familiar with the particular market conditions (World Bank, 2011a). Most of the capital invested was financed through debt, by securing loans from European and North American banks, or by issuing bonds on local and regional exchange markets. Development finance institutions have played a role by financing landmark infrastructure projects, such as submarine cables, with an important knock-on effect in attracting further foreign and domestic investment in the sector. France Telecom and Vodafone were the main private investors from the OECD area. More recently, India emerged as a new investor in African telecommunications, while China financed network equipment supplied by the large Chinese manufacturers (World Bank, 2011a).

Large-scale pan-African mobile operators were major players in this context, as they were able to use their licences in multiple countries to interconnect their networks and create borderless mobile telecommunication markets, eliminating roaming charges, one example being One Network in East Africa. A project initiated by Celtel, One Network was developed by Kuwait's Zain, starting in 2006, in order to offer telecommunication services free of roaming charges across 15 African countries, and since 2008 extending also to several Arab States (such as Bahrain, Iraq, Jordan and Sudan). The business model was born out of the need to cater for local demand in a market where ethnic groups can be separated by borders and consumers would find it extremely difficult to pay for high roaming charges (Sutherland, 2010). One Network was made possible by the liberalization of international gateways in several African countries, allowing Zain to obtain licences and interconnect gateways, effectively internalizing the issue of cross-border interconnection charges for on-network calls.

Table Box 4.7: Cumulative value of private-sector investment commitments in telecommunications in 15 African economies, 1990-2010

Economy	Cumulative commitments in telecommunications, 1990-2010 (million USD)	Share of greenfield projects in telecommunications (%)	Share of telecommunications in total private infrastructure commitments (%)	Telecommunication investment commitments, 2010 (million USD)
Kenya	5'093	90.7	81.8	492
Tanzania	2'727	93.1	79.7	625
Uganda	2'231	86.7	59.5	257
Congo (Dem. Rep.)	1'575	100.0	100.0	174
Burkina Faso	1'021	44.0	93.7	299
Benin	911	100.0	60.7	394
Malawi	713	100.0	95.2	116
Chad	604	49.8	100.0	354
Rwanda	494	75.7	99.6	63
Madagascar	484	91.1	83.3	132
Guinea	484	73.1	71.2	71
Sierra Leone	205	100.0	61.0	38
Liberia	159	100.0	35.4	15
Burundi	54	100.0	100.0	0
Central African Rep.	32	100.0	100.0	10

Source: World Bank PPI database.

Recent trends in FDI: ICT sector and telecommunication services

Total FDI inflows declined significantly in 2008 and 2009, and recovered only partially in 2010, given the persistence of borrowing constraints in the aftermath of the 2008 global economic downturn. The 2010 recovery occurred mostly thanks to profits registered in developing countries and kept in the home country as reinvested earnings. The developing economies' share of FDI continued to grow, 2010 being the first year when they received slightly more than half of total FDI inflows amounting to USD 1.24 trillion (UNCTAD, 2011b).

Like total FDI, ICT-related FDI slumped in 2008 and 2009 and only marginally recovered in 2010 (OECD, 2010a). At the same time, ICT markets continued to grow stronger in developing countries, where economic prospects were better. More importantly, several developing countries, such as China, Brazil, India and the Russian Federation, have also increasingly become attractive consumer markets, with promising growth prospects, and are recognized more and more by foreign investors as sources of substantial revenues (see Section 4.3).

Among the different types of FDI, cross-border M&As involving enterprises from the ICT sector dropped by half in 2009, as firms seemed to prefer investing at home. Contrary to this general trend, M&As nonetheless continued in non-OECD economies, resulting in an increase in their share over the last decade. In terms of value, 33 per cent of M&As in the ICT sector targeted enterprises from non-OECD countries in 2009, mainly Brazil, China, India, Indonesia, Singapore and South Africa. In turn, non-OECD ICT firms (mainly from Israel,[59] Saudi Arabia, Hong Kong (China), India, Qatar, Kuwait, United Arab Emirates and the Russian Federation) initiated acquisitions representing 24 per cent of the global value of ICT sector M&As. Some 60 per cent of the value of ICT sector M&As from 1998 to 2009 involved telecommunication firms (OECD, 2010a).

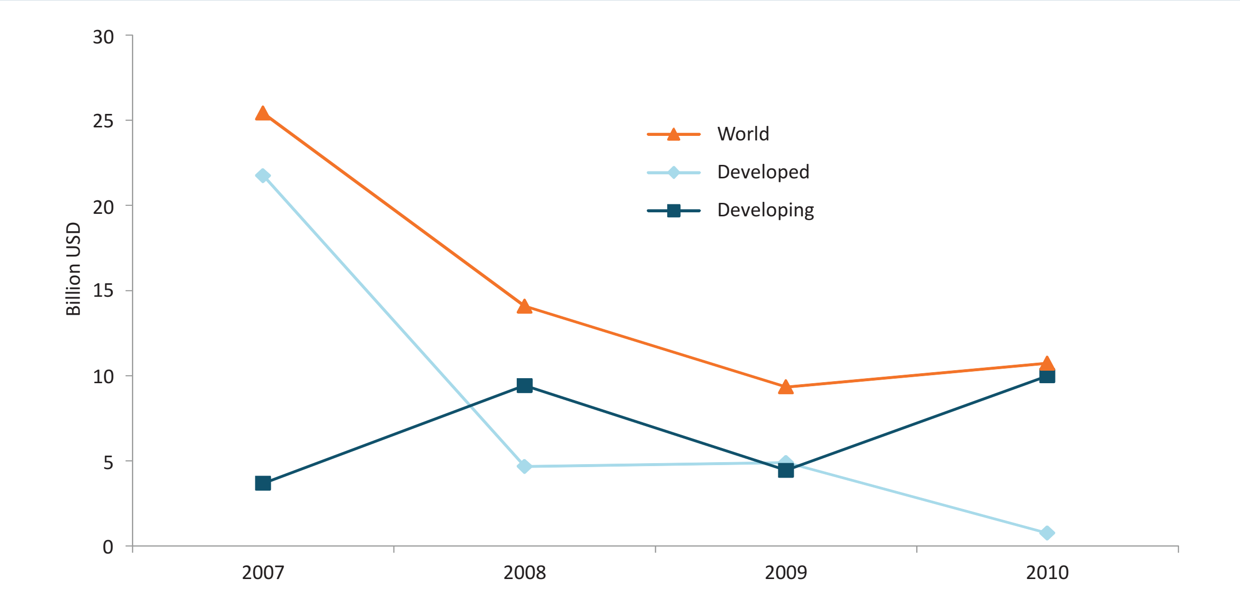
While there were fewer telecommunication M&As in the developed countries, where the industry had already achieved a high degree of consolidation, several developing economies registered significant M&A activity in 2010. Several transnational telecommunication operators pursued acquisitions in developing countries as a means of establishing a presence in these emerging markets, or in order to secure a higher share of revenues through consolidations in a context of declining prices. The convergence towards integrated triple- or quadruple-play also triggered consolidations, as operators attempted to balance low price offerings with the need to earn revenue to reinvest in infrastructure upgrades.

The developing country M&A activity mentioned above was also reflected in the trends in FDI inflows in telecommunications for 2007-2010 (Chart 4.12). In the countries for which data were available, FDI inflows in telecommunications declined in 2008 and 2009, picking up again in 2010. Developing countries performed better in both 2008 and 2010. In 2010, the main recipients of FDI in telecommunications were Denmark,[60] Brazil, Chile, India, Morocco[61] and Egypt,[62] each receiving between USD 1 and 4 billion in foreign capital inflows (Table 4.9). Relative to the value of total FDI inflows, telecommunications enjoyed a higher share in Morocco and Egypt, testifying of the success of these countries in attracting foreign investment in telecommunications as compared with other sectors of economic activity.

In Latin America, 2010 was a year of consolidation of fixed and mobile assets (ECLAC, 2010). It culminated with a large consolidation deal worth almost USD 23 billion, in which America Movil (Mexico), the leading regional mobile operator, acquired majority shares in the Mexican Carso Global Telecom, the holding company for Telmex, the Mexican fixed-line incumbent, and in Telmex Internacional, present in several Latin American countries.[64] In the same year, America Movil's main competitor in the region, Telefonica (Spain), consolidated its position in the Brazilian market by acquiring Portugal Telecom (Portugal)'s 50 per cent share in Vivo (Brazil) for USD 9.7 billion.[65]

In Africa, 2010 witnessed a landmark deal between developing economies, in which Bharti Airtel, the Indian leading mobile phone provider, acquired the operations of Kuwait's Zain in 15 African countries, for a total amount of USD 8.5 billion. Bharti concluded the deal with the declared intention to revive the growth of African mobile markets by competing on price and increasing the number of minutes of use in several African countries, where prices were typically higher than in India. The deal was reported as the

Chart 4.12: Main trends in FDI inflows in telecommunication services, by level of development, 2007-2010



Source: ITU, based on data from UNCTAD, OECD and ITU.
Note: Trends are based on a dataset of 49 economies with complete data series for the entire period and representing almost two-thirds (63 per cent) of global GDP in 2010. Included were 21 developed economies (accounting for 74 per cent of developed economies' 2010 GDP) and 28 developing economies (accounting for 42 per cent of developing economies' 2010 GDP). Aggregates were used to calculate trends rather than to estimate absolute figures.

Table 4.9: Main recipients of FDI inflows in telecommunications in 2010: top 10 economies with available data, by value of inflows, 2010[63]

	FDI inflows in telecommunications (million USD)				Telecommunications as a percentage of total FDI inflows			
Economy	2007	2008	2009	2010	2007	2008	2009	2010
Denmark	- 227	416	- 659	3'793	-1.9	22.8	-16.7	-51.2
Brazil	-1'453	387	-1'131	3'037	-4.2	0.9	-4.4	6.3
India	66	2'067	1'852	1'228	0.3	4.9	5.2	5.0
Morocco	377	30	663	1'222	13.4	1.2	34.0	93.7
Chile†	358	1'172	138	1'202	2.9	7.7	1.1	8.0
Egypt	1	999	1'001	997	0.0	10.5	14.9	15.6
Italy	7'943	- 135	96	577	19.8	1.2	0.5	6.3
Austria	- 512	357	261	561	-1.6	5.2	2.8	14.6
Czech Republic	495	- 594	-1'054	531	4.7	-9.2	-36.0	7.8
Argentina†	427	827	312	455	6.6	8.5	7.8	7.2

Source: ITU, based on data from UNCTAD, OECD and ITU.
Note: † Data refer to posts and telecommunications.

second biggest in India's history, and is expected to result in additional investment commitments from Bharti to expand network capacity and coverage.[66] Bharti had already gained a reputation for its Indian "minute factory model" operated under a scheme known as "managed capacity", in which construction and operation of the network were outsourced

to equipment vendors, allowing the operator to purchase only the amount of calling capacity actually needed, thereby effectively lowering operating costs.[67] The scheme also functions on the principle of infrastructure-sharing between operators, who buy leased tower capacity from vendors. Following the 2010 deal, Bharti took over Zain's African part of One Network, the world's first borderless mobile telephone network free of roaming charges. This move holds the potential to take the network sharing model a step further.

The accumulation of debt by telecommunication operators has been another important trend in recent years, particularly those based in developed countries (OECD, 2010a). Debt was also the preferred mode of financing the landmark emerging market M&As in 2010. This situation could affect the capacity of certain telecommunication carriers to contract additional loans with which to finance infrastructure investments. China Mobile was the only developing-country operator included in the OECD top 10 telecommunication firms, ranked by revenue, and the only one in this group to have positive net cash.

Turning to the origin of FDI, in 2007-2010 developed countries continued to be the main source of foreign investment in telecommunications (Table 4.10). At the same time, several developing economies from East Asia also contributed significantly to total outward stocks of investment in telecommunication. In 2009, Singapore, Malaysia and Hong Kong (China) increased their stocks of investment abroad in telecommunication, while several developed countries registered a decline, synonymous with disinvestments or loan repayments, as in the case of Spain, Belgium and France. In relative terms, Spain and the United Kingdom, through their leading operators, Telefonica and Vodafone, were the developed economies which dedicated the largest share of their outward foreign investment stocks to telecommunications. Among the

Table 4.10: Main economies by value of outward FDI stocks in telecommunication in 2009: top 20 economies with available data, by value of stocks, 2009

	Outward FDI stocks in telecommunications (million USD)				Telecommunications as a percentage of total outward FDI stocks			
Economy	2007	2008	2009	2010	2007	2008	2009	2010
United Kingdom†	189'805	N/A	169'913	N/A	10.3	N/A	10.2	N/A
Spain	71'094	73'635	60'353	N/A	12.2	12.5	9.8	N/A
United States	41'716	42'300	48'092	49'277	0.8	1.4	1.1	1.0
Netherlands	33'022	34'446	35'335	N/A	3.5	3.9	3.7	N/A
Germany	36'084	30'890	33'285	N/A	2.9	2.6	2.6	N/A
Belgium	N/A	26'679	23'004	20'215	N/A	3.3	2.6	2.2
Singapore†	10'784	10'225	12'138	N/A	4.9	4.9	5.7	N/A
Japan	2'782	7'390	10'851	21'813	0.5	1.1	1.5	2.6
Norway	11'691	10'872	10'629	7'904	8.0	8.1	6.5	4.2
France	29'498	40'788	10'398	4'129	2.8	4.0	0.9	0.4
Malaysia†	N/A	5'930	8'287	N/A	N/A	8.9	10.4	N/A
Hong Kong, China†	3'717	3'703	6 '666	N/A	0.4	0.5	0.8	N/A
Finland†	5'170	6'078	4'342	4'015	4.4	5.3	3.4	2.9
Austria	2'532	4'044	4'185	4'432	1.7	2.7	2.6	2.6
Greece	6'521	4'202	4'161	N/A	19.2	11.2	9.7	N/A
Italy	1'579	3'441	3'889	2'785	0.4	0.8	0.8	0.6
Denmark	5'675	3'865	3'614	2'287	3.1	2.0	1.7	1.1
Turkey	707	972	1'019	250	5.8	5.4	4.6	1.2
Korea (Rep.)	1'211	609	815	1'493	1.6	0.6	0.7	0.6
Slovenia	290	277	647	535	4.0	3.5	8.2	7.0

Source: UNCTAD and OECD databases.
Note: † Data refer to posts and telecommunications.

Table 4.11: Main private telecommunication companies, by cumulative value of total project investment and by region, 1990-2011 (USD million)

	Total telecom-munication investment commitments	East Asia and the Pacific	Europe and Central Asia	Latin America and the Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa
Telefonica SA (Spain)	81'555	0	0	81'555	0	0	0
America Movil (Mexico)	45'402	0	0	45'172	0	231	0
AT&T (United States)	37'299	0	252	36'429	0	619	0
Vodafone (United Kingdom)	35'289	134	6'947	0	4'839	11'939	11'432
Bharti Airtel Limited (India)	33'525	0	0	0	0	21'155	12'370
Telecom Italia (Italy)	32'226	0	320	31'906	0	0	0
TeliaSonera (Sweden)	28'965	2'601	26'019	0	0	345	0

Source: World Bank PPI database.
Note: Regional groups are based on the World Bank classification.

developing countries, Malaysia, home to Axiata Group Berhad, had the highest share of telecommunication in its outward FDI stocks.

Table 4.11 shows the main telecommunication service providers by value of their cumulative investment commitments in the sector over the last two decades. The regional distribution of projects confirms operators' preference for investing and providing services abroad in regions with which they have linguistic or cultural ties, or to which they are linked through the presence of large diasporas. Knowledge of the market has been a well-acknowledged competitive-advantage factor in telecommunications.

Besides telecommunication companies, large investments in telecommunications also came from banks (such as the Bank of America, United States) and conglomerates of developing countries with a current-account surplus, such as Abu Dhabi Group and Dubai Holding (UNCTAD, 2008).

4.5 Conclusions

The economic importance of the ICT sector reflects the global increase in uptake and use of ICTs. This chapter has shown that the structure of the ICT sector varies greatly between countries. In addition to telecommunication services, in some cases innovative ICT manufacturing and computer-related services make a significant contribution to economic growth. Hence the importance of designing comprehensive policy measures for the broader ICT sector with a view to fostering its development and its contribution to economic development.

The list of the largest telecommunication markets in terms of revenue generation includes the big emerging countries (BRICS), highlighting the economic potential of telecommunication services in the developing world. Despite the financial crisis that started in 2008, telecommunication revenue growth has continued at a steady pace in developing countries, whereas revenues have stagnated in developed countries. In relative terms, telecommunication revenues represent a higher percentage of GDP in developing than in developed countries, suggesting that telecommunications is a more important contributor to economic growth in the developing world. If policy-makers and operators in developing countries leverage the developments in mobile-cellular services to promote the uptake and use of other telecommunication services, such as broadband, an even greater and more extensive economic impact could be achieved.

The different policy approaches adopted to promote telecommunication developments in dynamic developing countries show that there is no one-size-fits-all approach. However, the growing importance of mobile revenues in

total telecommunication revenues points to mobile data services as the main driver of future revenue growth. This is confirmed by experience in developed countries, where mobile-broadband services are already the main source of revenue growth in the sector. Policy-makers and regulators can play a major role in accelerating the transition from traditional mobile-cellular services to mobile-broadband services. Indeed, investment in 3G and advanced wireless-broadband networks, such as LTE, will depend on licensing, on the regulatory environment and on other relevant policies adopted. In addition to mobile-broadband developments, developing countries should continue promoting the extension of mobile-cellular coverage to areas and populations not yet reached, particularly in Africa.

In an infrastructure business like telecommunications, investment is an essential factor for growth. Many of the positive developments documented by ITU over the past decade in terms of improved access to and higher affordability and increased use of ICTs have been underpinned by large-scale investments in telecommunication infrastructure. As this chapter has shown, private investment has played a leading role, thus ensuring that telecommunications develops as a sustainable business model, including in low- and middle-income countries. Foreign investors have participated actively and effectively in these developments by leveraging international or regional capital markets, and by bringing in their technical expertise and the latest technological know-how.

In low- and middle-income countries the telecommunication sector attracted relatively more investment (including foreign investment) in comparison with the other sectors of economic activity. As a large number of countries liberalized and opened up the sector to foreign investment, telecommunications achieved a high degree of business internationalization. The large number and high value of greenfield projects in telecommunications over the last two decades testifies of the quantity and value of investment dedicated to creating new productive assets in this sector.

This chapter has presented recent and historical trends in investment in telecommunications. A key finding is that developing countries continue to witness an increase in their share of global ICT and telecommunication markets, as the world economy and cross-border financial flows recover from the 2008 global economic downturn. Developing countries are increasingly recognized by investors as attractive destinations for capital outlays in telecommunications. At the same time, investors from developing countries are increasingly contributing to financing telecommunication development, exploiting their acquired experience in managing cost reductions and in catering for markets with lower purchasing power.

As technologies converge towards the delivery of triple- or multiple-play services, regulators are confronted with the challenge of ensuring timely infrastructure upgrades and maintaining competition. Service providers face the challenge of having to lower their prices while at the same securing the capital needed to upgrade and expand networks in order to support higher volumes of data traffic.

Data on investment in telecommunications, both domestic and international, are an essential variable for designing policies in the sector. Many national regulatory authorities, ministries and other information service providers acknowledge this fact by collecting and publishing investment-related information, facts and figures. However, as highlighted in this chapter, more efforts are needed to harmonize the collection of transparent and internationally comparable data on revenues and investment, while also ensuring that information is timely and reliable. Such data could help assess the annual value of investment flows in telecommunications in any given economy, the value of stocks owned by foreign investors in telecommunications, the income earned by foreign investors and the extent to which capital is allocated to investment in fixed assets and network development.

Endnotes

[1] The perception of which specific ICTs are to be considered as a general purpose technology has evolved over time. Initial studies identified semiconductors or microchips as a disruptive GPT (Bresnahan and Trajtenberg, 1995). However, since the invention of the microprocessor in 1971, technology has greatly evolved and new disruptive ICTs have emerged. As a result, recent studies and policy-makers have shifted the focus of attention to broadband, which is increasingly being recognized as the current key ICT general purpose technology (FCC, 2010; Katz, 2011; Kelly, 2009; OECD, 2008).

[2] World value of gross fixed capital formation retrieved from the World Bank database (http://databank.worldbank.org) on 7 May 2012.

[3] World value of GDP retrieved from the World Bank database (http://databank.worldbank.org) on 7 May 2012. Comparisons between sector revenues and GDP are only indicative. A more accurate measure in order to avoid double counting would require value-added data for the sector rather than revenue data.

[4] For example, this would be the case of a retail shop acquiring a computer and software to manage its accounting, or a kiosk in a rural area using a mobile-cellular phone to communicate with its suppliers.

[5] In Van Ark, Gupta and Erumban (2011), economies included in the analysis of global telecom investment are classified into two groups: 'advanced' or 'emerging'. All 'advanced' economies are developed ones according to the ITU classification, except Hong Kong (China), Israel, Korea (Rep.), Singapore and Taiwan (Province of China). 'Emerging' countries include mostly developing countries according to the ITU definition, but also some developed ones: Bulgaria, Czech Republic, Hungary, Poland, Romania, Russian Federation, Slovakia, Slovenia and Ukraine.

[6] For instance, in 2011 fixed (wired)-broadband penetration was estimated to be below 10 per cent in Africa, the Arab States, Asia and the Pacific and CIS.

[7] In an ICT sector classification based on two categories (ICT manufacturing and ICT services), ICT trade industries, as defined in ISIC Rev. 4, would be counted within ICT services industries. This is the case in ISIC Rev. 3.1 (which is the classification of economic activities still followed in several countries) and in the ICT sector classification proposed in Partnership (2010).

[8] This division of ICT services is used throughout the chapter for the purpose of comparing data available from different sources which follow national industrial classifications that cannot be completely disaggregated to ISIC Rev. 4 divisions. Telecommunication services correspond to division 61 (telecommunications) in ISIC Rev. 4. Computer services include several ISIC Rev. 4 divisions, which may vary slightly depending on the mapping of the national classification to ISIC divisions, but cover the rest of the ICT service sector.

[9] Software and IT services are included within computer-related services, i.e. within ICT service industries according to ISIC Rev. 4.

[10] See, for instance, Ramasamy and Ponnudurai (2011) and KCC's presentation at the 'ESCAP/DESA Roundtable on ICT Access and e-Government for Achieving the MDGs', June 2010, available at: http://www.unescap.org/idd/events/2010_ESCAP_DESA_Roundtable_ITC/3-KCC.pdf.

[11] Although in Cameroon there are no available data on value added of the ICT manufacturing sector, it is assessed to be close to negligible in comparison with ICT services. The ICT sector in the country is dominated, in particular, by telecommunication services (Nzépa, Tankeu and Esse, 2011).

[12] Although there are no data available on value added of the ICT manufacturing sector in Egypt, revenue data show that telecommunications accounts for about 70 per cent of total revenues in the sector. Accordingly, value added of ICT manufacturing is assessed to correspond to a relatively small share of total ICT value added (El-Shenawy, 2011).

[13] Data retrieved from the Telco telecommunications portal (http://www.teleco.com.br/en/en_celprod.asp) on 10 May 2012.

[14] The majority of this employment corresponds to call boxes (retailers of mobile-cellular services), in most cases single-person businesses established in public spaces. These microbusinesses depend on traditional mobile-cellular services for their own communications: 94 per cent own a cellphone, while 30 per cent have a computer, 13 per cent Internet access and only 9 per cent a fixed telephone (Tankeu, 2010).

[15] See also UNCTAD (2011a).

[16] GDP data retrieved from the World Bank database (http://databank.worldbank.org) on 22 May 2012.

[17] In USD terms, Switzerland has the fifth most expensive fixed-telephone sub-basket and the sixth most expensive mobile-cellular sub-basket in the 2011 ICT Price Basket (Chapter 3).

[18] GDP data retrieved from the World Bank database (http://databank.worldbank.org) on 22 May 2012. The classification of developed and developing countries corresponds to M49 standard of the United Nations (see http://unstats.un.org/unsd/methods/m49/m49regin.htm).

[19] Data in local currency are more robust against exchange-rate fluctuations. For instance, Mexico experienced a continuous increase in total telecommunication revenues in local currency from 2007 to 2010. However, since the Mexican peso underwent a significant depreciation between 2008 and 2009, data in USD show telecommunication revenues as having decreased between those years, even though in local currency they actually increased.

[20] See the EGTI online forum: http://www.itu.int/ITU-D/ict/ExpertGroup.

[21] Viet Nam is classified as a lower-middle-income country according to the World Bank income groups. See http://data.worldbank.org/about/country-classifications.

[22] Data in this section refer to revenues from all mobile services, including voice, sms and data.

[23] In 24 out of the 26 developed countries for which mobile revenue data are available for the period 2007-2010, mobile-cellular penetration had passed the 100 per cent mark in 2010.

[24] See endnote 19.

25 Data retrieved from PTS's report *The Swedish Telecommunication Market 2010*, available at http://www.statistik.pts.se/pts2010e.

26 Simple averages taken for all countries for which data are available.

27 The Republic of Korea is the world leader in fibre-to-the-home penetration, and has a highly developed fixed market. The country's situation in terms of telecommunication development corresponds more to that of a developed country than a developing country.

28 In Brazil, the three main telecommunication groups are horizontally integrated and cover fixed-telephone, mobile-cellular, fixed-broadband and pay-TV services, thus diversifying revenue sources. This partly explains the lower weight of mobile revenues in the sector total in Brazil in comparison with other developing countries.

29 For example, by 2010 there were 15 bundled subscriptions per 100 inhabitants in the European Union (including double and triple-play). Source: European Commission (2011c).

30 Sweden and the United States saw the first commercial launches of LTE as early as end 2010. In Canada and the United Arab Emirates, LTE networks were commercially launched in 2011.

31 For example, in Malaysia capital intensity (i.e. fixed assets per employee) in telecommunications is more than ten times higher than in ICT computer services, and more than seven times higher than in the ICT manufacturing sub-sector (Ramasamy and Ponnudurai, 2011).

32 Upgrade of traditional networks to NGN implies enhancements in the core network as well as the deployment of fibre technologies in the last mile (e.g. FTTH).

33 In 2011, 300 million new active mobile-broadband subscriptions were added worldwide, and the total number of active subscriptions reached 1.1 billion.

34 See, for instance, Jabbour and Redding (2001); and Yoo, Lyytinen and Yang (2005).

35 See, for example, van Damme (2002) and OECD (2001).

36 Verizon was the first operator to launch a large 3G network in the United States, see http://news.verizonwireless.com/news/2002/01/pr2002-01-28.html.

37 Some remarkable exceptions are Bahrain and the United Arab Emirates, where 3G services were already launched by end 2003 (ITU, 2012).

38 See for instance Xia (2011) and India's Department of Telecommunication's press release: http://www.dot.gov.in/as/Auction%20of%20Spectrum%20for3G%20&%20BWA/Auction%20results/3G_Auction_-_Final_Results.pdf.

39 For more information on 3G coverage in Brazil, see the statistics from Teleco at http://www.teleco.com.br/3g_cobertura.asp.

40 Entities providing telecommunication services to the public are classified in ISIC Rev. 4, Division 61 (Telecommunications).The ITU definition of capital expenditure in telecommunications can be found in ITU (2011a), pp. 109-110.

41 Investment data for India have been collected on the basis of capital expenditure figures obtained from the annual reports of the following operators: Bharti Airtel, BSNL, Idea, MTNL, Reliance, Tata (Teleservices)and Vodafone.

42 See Endnote 19.

43 ITU (2012).

44 See http://www.cellular-news.com/story/43784.php.

45 El-Shenawy (2011).

46 See http://ir.telecomegypt.com.eg/press%20releases/press%20releases/Telecom%20Egypt%20Announces%20The%20Launch%20of%20Its%20Fiber%20To%20The%20Home%20Services%20in%20Cairo.pdf.

47 http://www.tra.gov.eg/emisr.

48 For more information, see 2010 press releases on Datame's launch of mobile WiMAX (http://www.datame.fi/index.php?id=20#a1), Elisa's launch of LTE (http://www.elisa.com/on-elisa/140/130.00/16791/) and TeliaSonera's launch of LTE (http://www.teliasonera.com/en/newsroom/press-releases/2010/11/teliasonera-first-to-launch-4g-in-finland/).

49 For an example of recent broadband network deployments in the United Kingdom, see BT's website on the status of fibre roll-out: http://www.btplc.com/ngb/Rolloutprogress/index.htm.

50 See, for example, McKinsey (2009), *Inside the US stimulus program: Implications for three industries*. Available at: http://www.mckinseyquarterly.com/Inside_the_US_stimulus_program_Implications_for_three_industries_2383.

51 They are influenced by exchange-rate fluctuations and price changes.

52 For a summary of the literature on impacts, see UNCTAD (2008).

53 See, for example, Andres et al. (2005) and Minges (2008).

54 Telecommunication activities in this database include fixed access, mobile access and long-distance, but exclude value-added services, such as data transmission. Resellers of long-distance services, which usually operate by leasing circuits or capacity from long-distance carriers, are also excluded.

55 References to income levels are based on the World Bank classification, see: http://data.worldbank.org/about/country-classifications/country-and-lending-groups. The low-income and middle-income group includes low-income, lower-middle-income and upper-middle-income economies.

56 The World Bank database underestimates telecommunication investments in facilities to the extent that telecommunication operators, particularly the ones that are not publicly traded, do not release information on investment.

[57] A distinction can be made between different types of private investment projects, such as those committed to creating new productive assets (greenfield investment) and those related to the acquisition of existing assets by the private sector (privatizations).

[58] Comoros, Djibouti, Eritrea and Ethiopia are the only four countries to maintain restrictions on FDI in telecoms.

[59] Israel became a member of OECD on 7 September 2010. The figure in the text refers to 2009.

[60] In 2010 TDC, the leading Danish telecommunication operator, issued an initial public offering (IPO) on the Copenhagen Stock Exchange, seeking capital to expand. This was one of the largest IPOs in European telecommunications since 2004. At the same time, TDC disinvested its share in Sunrise (Switzerland), transferring capital back home. See: http://files.shareholder.com/downloads/ABEA-4C7P5P/1909343760x0x438793/0969dd29-a61c-499f-b751-8785c22f7a0e/ER_FY2010_Presentation.pdf.

[61] In Morocco, recent flows of foreign investment were associated with increased competition, owing to the emergence of Wana, a third mobile operator, resulting in a booming 3G market and an increase in mobile subscription penetration to 100 per cent in 2010. Wana's operations were financed by a joint venture between Zain (Kuwait) and Al Ajial Investment Fund Holding, which committed to buying 31 per cent of Wana's shares, worth USD 324 million. See: http://www.itp.net/549560-zain-to-acquire-31-stake-in-wana .

[62] In Egypt, foreign investment flows in telecommunications coincided with the launch of 3G services in 2008 by three operators with foreign equity participation: Vodafone Egypt, Etisalat and ECMS Mobinil (partly owned by Orange and Orascom). See: http://www.eiu.com/index.asp?layout=displayIssueArticle&issue_id=1817792966&article_id=1977792982.

[63] Data on FDI flows are presented on a net basis: capital transaction credits less debits between direct investors and their foreign affiliates. Net decreases in assets or net increases in liabilities are recorded as credits (with a plus sign), while net increases in assets or net decreases in liabilities are recorded as debits (with a minus sign). Hence, FDI flows with a minus sign indicate reverse investment or disinvestment (UNCTADStat).

[64] See http://www.americamovil.com/amx/en/cm/about/events.html?p=28&s=38 and http://www.telegeography.com/products/commsupdate/articles/2011/08/02/am-announce-plans-to-buy-remaining-telmex-stake/.

[65] http://www.reuters.com/article/2010/07/28/us-telefonica-pt-idUSTRE66R0S820100728.

[66] http://in.reuters.com/article/2010/06/09/idINIndia-49129920100609.

[67] http://www.economist.com/node/14483880/print.

Chapter 5. Measuring communication capacity in bits and bytes

5.1 Assessing global communication capacity

In view of the growing number of telecommunication subscriptions worldwide, it is increasingly interesting to analyse usage, as a complement to information on penetration rates. It is important to continue measuring the digital divide in terms of subscriptions per capita; in addition, however, as the population of connected individuals expands, in both developed and developing countries, usage indicators are becoming more and more relevant.

There are multiple ways and means of measuring ICT usage.[1] Data on telecommunication traffic capture trends in the use of telecommunication networks. Traffic data - both domestic and international, over fixed- and mobile-telephone networks – also serve as the basis for deriving key performance indicators such as minutes of use per subscription and average revenue per minute (ITU, 2011a). Yet while many countries measure voice traffic few countries currently measure data traffic over telecommunication networks, and there is a lack of harmonization in respect of how the latter data are reported. Efforts are currently under way to revise and improve the indicators and methodology for measuring traffic and backbone capacity, through discussions in the ITU Expert Group on Telecommunication/ICT Indicators (EGTI).[2]

This chapter provides an estimate of the global capacity to transmit and receive data in bits and bytes, with a view to highlighting the relevance of measuring communication capacity and traffic.[3] The estimate is based on the methodology developed by Hilbert and López (2011 and 2012a), and builds on a large number of data sources, including statistics on the number of subscriptions to different ICTs from the ITU World Telecommunication/ICT Indicators database.[4] It is important to point out that most of the existing telecommunication/ICT indicators focus on the number of subscriptions to ICTs and the respective investments, costs or spending. While these indicators constitute key inputs for compiling the estimates, they only provide rough approximations of the amount of bits and bytes exchanged worldwide through voice and data traffic over communication networks. There is in fact a significant and growing difference in trends between the number of subscriptions and the amount of information communicated globally. While growth in the number of subscriptions worldwide has reached a certain degree of saturation in several countries, as for example in the case of mobile-cellular services,[5] the increase in global communication capacity shows no signs of abating.

Using the unifying metric of bits per second, employed for measuring global technological capacity to communicate, it is possible to compare different communication technologies. It is also possible to analyse bits per second per capita, per technology, per country or per any other relevant socio-economic or demographic parameter.

Communication traffic has already been used as a key variable in several studies. This approach has provided interesting new insights, even when focusing only on

traffic over a single technology, such as fixed-telephone traffic[6] or Internet traffic.[7] Several national public organizations, sometimes in collaboration with the private sector, have provided assessments of Internet traffic and fixed-broadband quality.[8] A handful of studies have estimated the amount of information communicated over ICT networks, often using different metrics, such as the number of word equivalents, the number of hours of consumption or the number of optimally compressed bits, depending on the focus of the research in question.[9] Communication capacity is a relatively new measurement area, not yet fully consolidated and with methodologies still maturing, but one which can provide analytically interesting insights (Hilbert, 2012).

5.2 Methodology for measuring communication capacity

Two statistical indicators are used for measuring communication capacity (Hilbert and López, 2012a and 2012b):

- **Subscribed capacity**, also referred to as "subscribed bandwidth potential", is based on the annual number of subscriptions to selected telecommunication services, multiplied by the communicational performance of the underlying technology, as measured by the average bandwidth in bits per second of a communication device (e.g. 64 kbit/s

Box 5.1: Notes on the methodology

The analysis covers 30 different telecommunication technologies (e.g. dial-up and DSL Internet; GSM and WCDMA mobile; etc.) (see Table 5.1), grouped under four different categories: fixed telephone, mobile-cellular telephone, fixed Internet and mobile data. Data on broadband speeds are from NetIndex, Ookla,[11] which collects the results of end-user initiated bandwidth speed tests per country and per day, for recent years. In addition to telecommunications, three different groups of broadcasting technologies (unidirectional) were also considered in the analysis (TV, radio and GPS), corresponding to 12 different kinds of technologies (e.g. terrestrial over-the-air TV; and cable TV; etc.) (see Table 5.1).

The calculated communication capacity values (both subscribed capacity and effective capacity) are based on estimated average communication performance rates per type of technology (see Table 5.1). The hardware capacity refers to the amount of binary digits that can be sent. However, it is also necessary to take into account the fact that technologies can transmit data symbols with different levels of compression. For example, it was estimated that in 2007 on average a fixed-telephone line had a hardware performance of 64 kbit/s (in terms of voice transmission), while a mobile-cellular telephone transmitted less than 10 kbit/s (around 8.5 kbit/s). Without accounting for compression, the upshot would be that a fixed-telephone voice transmission has more than seven times the capacity of a mobile-telephone voice transmission (64/8.5). This difference is largely due to the fact that voice content is much more efficiently encoded in mobile telephony than in fixed telephony (and not to a higher quality of fixed voice as compared with mobile voice transmissions).[12]

To make communication capacity comparable across the different technologies considered, hardware capacity is thus adjusted for optimal compression rates.[13] Normalized for optimal compression rates, a digital fixed telephone transmits an average of 12 kbit/s (not 64 kbit/s), while a mobile-cellular telephone transmits around 8 kbit/s. These values reflect more closely the amount of information transmitted in binary digit signals (also referred to as the informational capacity). Accordingly, a digital fixed telephone transmits roughly 50 per cent more information than a 2G GSM-AMR mobile-cellular telephone (12/8) (not seven times more); or, conversely, a 2G mobile-cellular telephone achieves two-thirds of the information richness of a fixed telephone (8/12).

Similar calculations show that, in 2010, the amount of data transmitted globally via the fixed Internet, in optimally compressed bits, was three times the volume of data transferred over telecommunication networks in 1986, 25 years earlier. The right-hand column in Table 5.1 shows the communication capacity in optimally compressed bits (or the informational capacity) for 2007. The values are based on the methodology developed in Hilbert and López (2011, 2012c), and are used as a proxy for estimating the global amount of subscribed capacity in bits and bytes.

for fixed telephony, or 56 kbit/s for Internet dial-up, as shown in Table 5.1).

- **Effective capacity**, also known as "effective usage" or "traffic capacity", tracks only the bits that are effectively communicated within the subscribed capacity. This measure makes it possible to control for the time when technology in not being used. Effective capacity is calculated as the product of subscribed capacity (measured in bits per second)

Table 5.1: Estimated average communication performance rates by type of technology, 2007 (kbit/s)

Category	Technology	Average hardware capacity (in kbit/s) downstream/upstream	Average informational capacity (in optimally compressed kbit/s) downstream/upstream
Telecommunications (bidirectional)			
Fixed telephony	Fixed telephone analogue	104 / 104	8.6 / 8.6
	Fixed telephone digital	64 / 64	12 / 12
Fixed Internet	*Dial-up*	56 / 48	44 / 38
	ISDN BRI	128 / 128	102 / 102
	ISDN PRI	1'935 / 1'935	1'539 / 1'539
	Cable Modem	6'563 / 1'009	5'219 / 802
	DSL	2'286 / 654	1'817 / 519
	FTTH/B	18'696 / 4'917	14'873 / 3'912
	Other/unidentified	947 / 897	748 / 709
Mobile voice telephony	Analogue (1G)	102 / 102	6.4 / 6.4
	GSM (2G)	8.5 / 8.5	8.0 / 8.0
	cdmaOne (2G)	13 / 13	4.0 / 4.0
	PDC (2G)	6.7 / 6.7	6.5 / 6.5
	TDMA (2G)	8.0 / 8.0	4.0 / 4.0
	iDEN (2G)	4.0 / 4.0	4.0 / 4.0
	GSM/GPRS (2.5 G)	8.5 / 8.5	8.0 / 8.0
	GSM/EDGE (2.5 G)	8.5 / 8.5	8.0 / 8.0
	CDMA2000 1x (3G)	8.6 / 8.6	5.6 / 5.6
	WCDMA / UMTS (3G)	15 / 15	11 / 11
	CDMA2000 1xEV-DO(3G)	13 / 13	12 / 12
Mobile data	*GSM (2G)*	14 / 14	11 / 10
	cdmaOne (2G)	19 / 14	15 / 5
	PDC (2G)	29 / 29	22 / 20
	TDMA (2G)	10 / 10	7.4 / 6.7
	iDEN (2G)	19 / 19	15 / 13
	GSM/GPRS (2.5 G)	46 / 14	35 / 10
	GSM/EDGE (2.5 G)	100 / 42	77 / 29
	CDMA2000 1x (3G)	80 / 80	61 / 55
	WCDMA / UMTS (3G)	350 / 350	268 / 243
	CDMA2000 1xEV-DO (3G)	500 / 80	383 / 55
Broadcasting (unidirectional)			
Radio	Radio analogue	706 / 0	35 / 0
	Radio digital	192 / 0	71 / 0
GPS	*Personal navigation*	0.46 / 0	0.23 / 0
Television	TV-Terrestrial analogue (black & white)	59'921 / 0	1'010 / 0
	TV-Terrestrial analogue (colour)*	87'849 / 0	1'487 / 0
	TV-Cable analogue*	87'255 / 0	1'477 / 0
	TV-Satellite analogue	90'560 / 0	1'533 / 0
	*TV-Digital (x3):** Terrestrial / Cable / Satellite*	4'256 / 15	2'144 / 11

Source: Hilbert and López (2011, 2012c).

Note: The table does not cover all existing mobile technologies. Digital technologies are in italics. *The average performance of analogue terrestrial TV is higher than the average performance of analogue cable TV because there are proportionally more cable TV subscriptions in the United States and Japan (where NTSC is the standard), and NTSC has a lower performance than PAL/SECAM. ** There is one exception in the distinction between one-way broadcasting and two-way telecommunications. Technically, digital television has an upstream link and could therefore be classified as a telecommunication technology.

and the fraction of time during which technology is being used for communicating information at full capacity. In practice, this statistic can be obtained either by measuring data traffic in backbone networks or at the end user, or from media consumption studies.[10] Box 5.1 provides additional information on the methodology used.

There can be significant differences between the subscribed capacity and the effective capacity. To estimate the capacity effectively used, it is necessary to have information on the times of use of a technology (per day). Hilbert and López (2011, 2012c) estimate that the average broadcasting receiver ran for almost three hours a day in 2007. This means that, for broadcasting, subscribed capacity (bandwidth potential) was eight times larger than effective capacity (traffic) (three hours vs 24 potential hours). Similarly, in 2007, the average Internet subscription effectively transmitted information only for some nine minutes per day (Hilbert and López, 2011, 2012c). This is at odds with survey results which indicate that the average Internet user reported being online for more than 90 minutes per day (WIP, 2010). Considered together, these data suggest that the average modem only transmits information during 10 per cent of the time during which the user interacts with the device, while for the rest of the "usage/consumption session" the screen might be on and the user might be reading, listening or watching, but no effective telecommunication takes place through the modem.[15] Therefore, for the purpose of estimating effective capacity, traffic data were preferred to data on "user-reported consumption".

5.3 Broadcasting and telecommunications: How do they compare in terms of effectively used capacity?

This section takes a global look at the effective capacity of several telecommunication and broadcasting technologies. Statistics on capacity effectively used are compared with statistics on the number of subscriptions[16] worldwide for each of the technologies considered, for the years 1986, 1993, 2000 and 2007 (Charts 5.1 and 5.2).

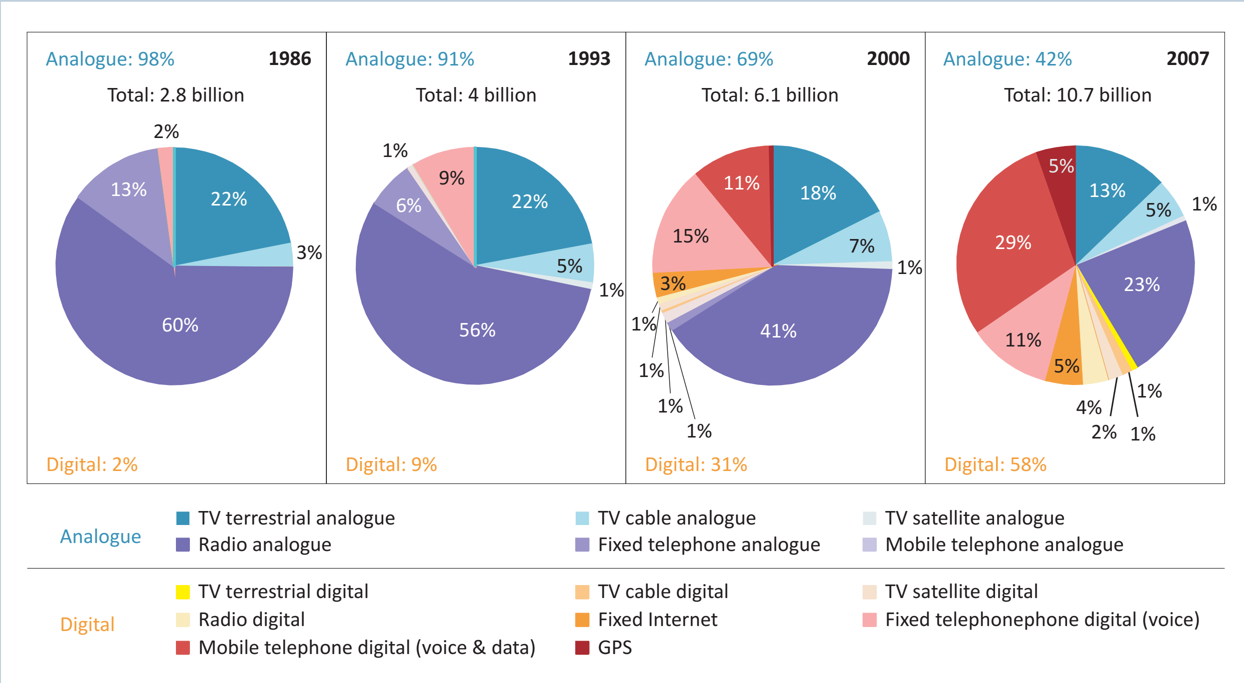
As emerges from Chart 5.1, the total number of subscriptions to communication technologies taken together almost tripled over the two decades considered, from 2.8 billion to 10.7 billion. In 1986, no fewer than 98 per cent of all subscriptions were to analogue technology. Analogue technologies began to be gradually replaced as from 2000, and by 2007 the majority of subscriptions to communication services were digital (58 per cent). Back in 1986, the dominating communication technology was radio, representing 60 per cent (or 1.7 billion radio sets). Thereafter, the share of television and fixed-telephony subscriptions remained relatively constant (at around 25 and 15 per cent, respectively), while the share of radio (analogue) declined considerably, to 22 per cent. In 2007, the largest share of the pie was captured by mobile-cellular telephones (29 per cent), while fixed Internet subscriptions represented 5 per cent of the worldwide stock of subscriptions to telecommunication services.

Chart 5.2 shows the same technologies in terms of their contribution to effective communication capacity worldwide. Effective usage times for each technology were obtained from media consumption studies for the years 1986, 1993, 2000 and 2007, and interpolated linearly between those years.[17] Over the last two decades, effective capacity grew by a factor of 4.5, from 432 exabytes (EB) to almost 2 zettabytes (ZB).[18] This implies that, on average, a person communicated 240 MB per day in 1986 (the equivalent of ten CD-ROMs per month), 350 MB per day in 1993 (15 CD-ROMs per month), 520 MB per day in 2000 (22 CD-ROMs per month) and some 800 MB per day in 2007 (equal to roughly 34 CD-ROMs per person per month).[19]

Television broadcasting clearly dominated the global effective communication capacity, with a share of between 93 and 96 per cent. Analogue over-the-air terrestrial TV was gradually replaced by cable and satellite technology, and more recently by digital TV. Some 7 per cent of all the bits communicated were transmitted by radio in 1986, as compared with only 2 per cent in 2007.

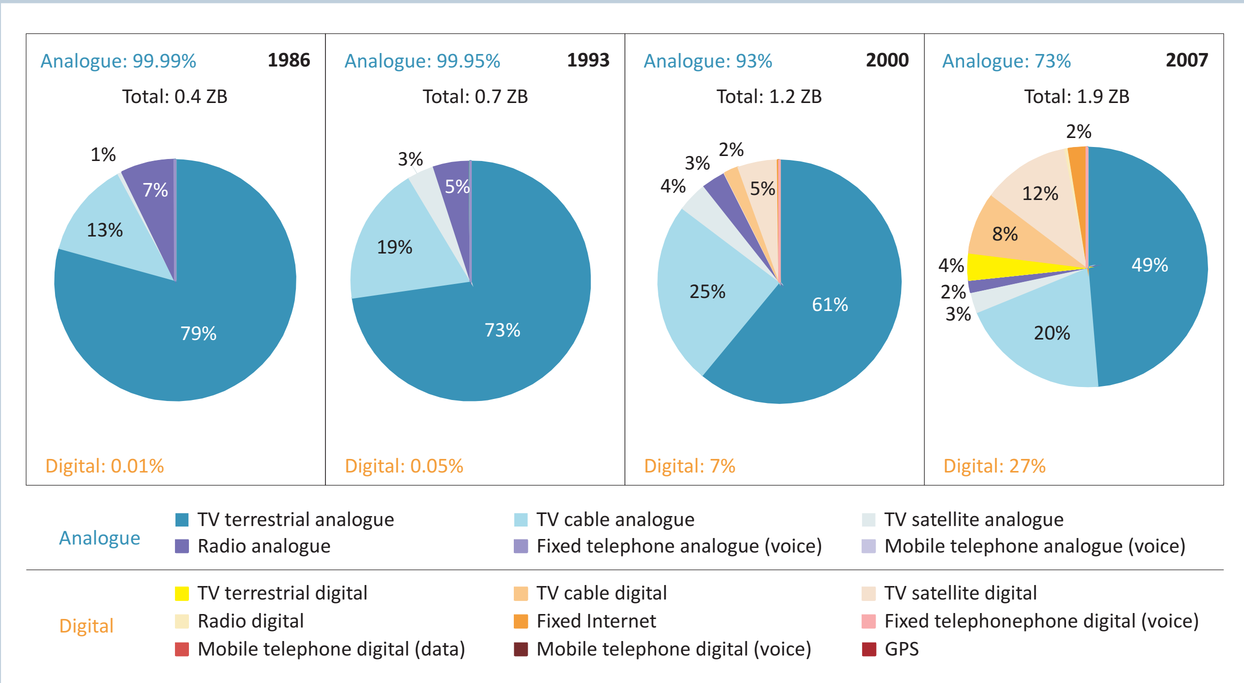
Fixed Internet contributed less than 3 per cent to the total amount of optimally compressed bits effectively communicated in 2007. Mobile voice and data traffic represented less than 0.1 per cent of the total in 2007.[20] As a consequence of the dominance of TV, the global landscape of effective communication capacity was still

Chart 5.1: Global subscriptions to communication technology, 1986, 1993, 2000, 2007



Source: ITU (2011e).

Chart 5.2: Global effective communication capacity, in optimally compressed zettabytes*, 1986, 1993, 2000, 2007



Source: ITU (2011e).
Note: *1 zettabyte (ZB) = 10^{21} bytes.

dominated by analogue technologies (Chart 5.2). It was estimated that only 27 per cent of globally transmitted bits were digital in 2007. This contrasts with the situation in regard to information computation or storage, areas where digital information had already gained supremacy (Hilbert and López, 2011). Digital satellite television led broadcasting technologies into the digital age, as it represented 44 per cent of all digitally transmitted bits in 2007, while digital cable TV accounted for 31 per cent of all digital information flow. Fixed Internet contributed 9 per cent to the digital share.

On the other hand, effective capacity in telecommunications grew much more strongly than effective capacity in broadcasting, reaching a compound annual growth rate (CAGR) of some 28 per cent over the last two decades (compared with only 7 per cent for broadcasting). This growth was pushed by ever more advanced digital telecommunication technology, with higher capacity to transmit bits per second. While only 20 per cent of the world's telecommunicated bits were delivered over digital networks in 1986 (representing the incipient digitization of the fixed network), digital technology already mediated as much as 69 per cent of telecommunication traffic by 1993, 97.7 per cent in 2000 and 99.9 per cent in 2007. It is estimated that 1990 marked the turning point from the supremacy of analogue towards a transition to digital telecommunications.

5.4 Subscriptions and subscribed capacity in telecommunications

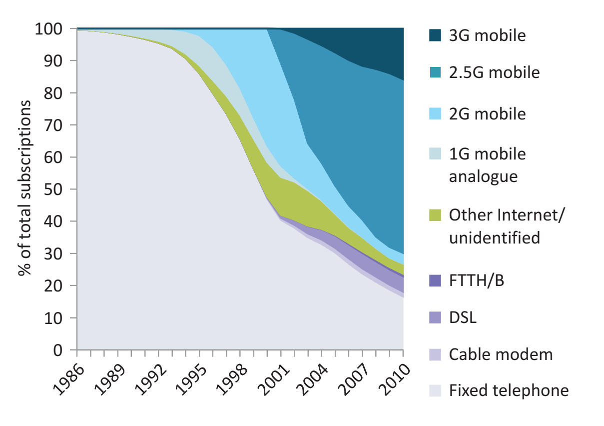
This section provides a global comparative analysis of telephony and Internet, fixed and mobile, voice and data, from 1986 to 2010, by looking at the 30 telecommunication technologies included in Table 5.1. It focuses on the subscribed capacity in telecommunications, as opposed to the effective capacity, because statistics for traffic flow and/or effective usage in different countries are not easily available.[21] Results for individual countries are given later in the section.

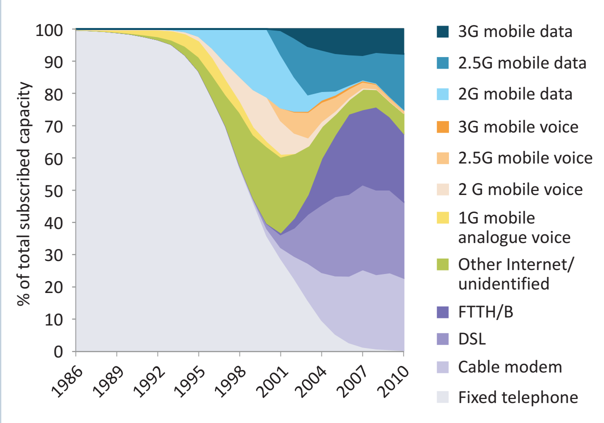
The global distribution of subscriptions and subscribed capacity in telecommunications (in optimally compressed bits), 1986 to 2010, is shown in Chart 5.3. As can be seen from the graph in Chart 5.3 (left), telecommunication subscriptions grew from 424 million in 1986 to 641 million in 1993, climbed to 1.8 billion in 2000 and 3.6 billion in 2005, and then surged to 6.9 billion by 2010. In 1986, more than 99 per cent of telecommunication subscriptions were to fixed telephone. This did not change significantly before the mid-1990s (94 per cent in 1993). By 2000, 2G mobile (GSM, cdmaOne, PDC, TDMA, iDEN) already represented one-third of subscriptions. Between 2007 and 2010, mobile occupied a stable three-quarters of global telecommunication subscriptions. 2.5G mobile telephony (capable of transmitting data with GPRS and EDGE) was the most widespread mobile technology in 2007, with around half of all telecommunication subscriptions. Between 2000 and 2010, fixed Internet subscriptions contributed a stable 10 to 15 per cent to the global stock of telecommunication subscriptions.

The graph in Chart 5.3 (right) depicts the contribution of different telecommunication technologies to global subscribed capacity. In 1986, fixed telephony represented 99.8 per cent of the world's subscribed capacity in telecommunications, while the rest was contributed by analogue mobile phones (1G) and the incipient fixed Internet (0.001 per cent). Around 2000-2001, fixed telephony, fixed Internet and mobile telephony each contributed roughly one-third of global subscribed capacity in telecommunications. Since then, data communications have taken over. In 2007, fixed Internet reached its peak in terms of subscribed capacity, accounting for some 80 per cent. Mobile data services caught up rapidly, capturing 25 per cent of total subscribed capacity in 2010. In the same year, digital subscriber line (DSL), cable modem and fibre-to-the-home/building (FTTH/B) contributed roughly equally to the world's subscribed capacity in telecommunications (about 20 per cent each).

A comparison between the two graphs in Chart 5.3 highlights the fact that statistics on communication capacity are an important complement to statistics on the number of subscriptions. In 2007, fixed telephony represented 25 per cent of global telecommunication subscriptions, but only provided 1 per cent of subscribed

Chart 5.3: Global distribution of subscriptions (left), and subscribed capacity (right), for selected telecommunication technologies, 1986-2010





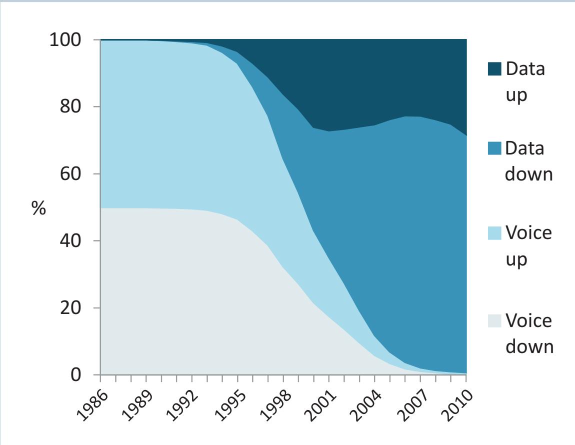
Source: ITU (2011e).
Note: Capacity is measured in optimally compressed kbit/s.

capacity. Mobile phones accounted for two-thirds of subscriptions, but less than one-fifth of subscribed capacity. The share of fixed Internet was more than seven times larger in terms of subscribed capacity than in terms of subscriptions (80 and 11.5 per cent, respectively).

Previously, when telecommunication networks were predominantly used for voice communications (and when most of the current data tracking efforts began), the number of subscriptions was a good proxy for subscribed capacity in telecommunications, because voice required roughly the same amount of bandwidth capacity per subscription. As data traffic becomes more prominent, however, statistics on the number of subscriptions are no longer sufficient for estimating subscribed capacity.

The shift from voice-based telephony to Internet data transmission during the decade between 1994 and 2004 changed the traffic data pattern, as shown in Chart 5.4. The increase in Internet data transmission resulted in a growing imbalance between the upstream and downstream subscribed capacities, which had been perfectly balanced when voice traffic dominated the telecommunication landscape prior to 1997 (because voice traffic is symmetric). Since the mid-2000s, global digital data channels have been built so that users can receive three times more information than they can send.[22]

Chart 5.4: Subscribed capacity for downstream and upstream telecommunications, 1986-2007



Source: ITU (2011e).
Note: Capacity is measured in optimally compressed kbit/s.

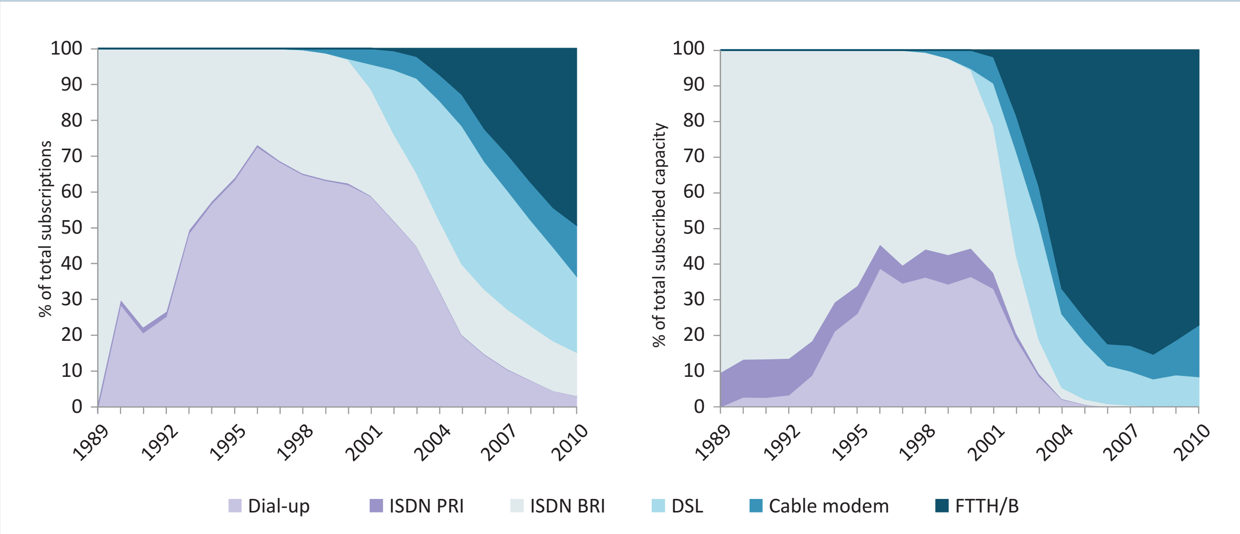
Box 5.2 provides a country example, highlighting the insights gained from estimating subscribed capacity for fixed Internet.

Box 5.2: Comparing fixed Internet subscriptions and subscribed capacity: the case of Japan

Japan is an example of a country which has seen an impressive transformation of its telecommunication sector in the last two decades (as shown in Chart Box 5.2). In the late 1980s, in Japan the Internet was almost exclusively accessed by organizations such as universities and private companies, which used ISDN BRI (integrated services digital network basic rate interface, which is known as INS64 in Japan). During the 1990s, dial-up access contributed greatly to the spread of access to the Internet in Japanese households. In 2000, dial-up technology was still the preferred type of Internet access for 62 per cent of Japanese subscriptions, accounting for 37 per cent of subscribed Internet capacity. The situation changed drastically in the next few years. Contrary to the majority of other countries (compare with Chart 5.3), Japan pretty much "leapfrogged" the transition to DSL and cable-modem broadband access, and moved almost directly from dial-up Internet to fibre optics (FFTH/B). This development benefited from the e-Japan strategy and policy programme announced in 2001. Literally inexistent in 2000, FTTH/B technology represented 30 per cent of Japan's fixed Internet subscriptions in 2007, and more than 80 per cent of the country's subscribed capacity for fixed Internet. While the number of fixed Internet subscriptions stabilized between 2002 and 2010 at around 39 million (equivalent to 31 subscriptions per 100 inhabitants), and does not seem to be growing further, during the same period subscribed bandwidth capacity grew from an average of 175 kbit/s per subscription to an impressive 21 Mbit/s per subscription.

In summary, measuring fixed Internet developments in Japan in terms of number of subscriptions and subscribed capacity gives two different perspectives on the far-reaching revolution that has taken place.

Chart Box 5.2: Fixed Internet subscriptions (left), fixed Internet subscribed capacity (right), by technology, Japan, 1989-2010



Source: ITU (2011e).
Note: Capacity is measured in optimally compressed kbit/s.

Drivers of subscribed telecommunication capacity

From a supply-side perspective, growth in the world's subscribed telecommunication capacity can be driven by factors such as: more subscriptions (or uptake of services), improvements in hardware performance and better compression algorithms (software performance).[24] Using an analogy, the underlying logic can be likened to filling a certain number of tubes (infrastructure) of different sizes (hardware) with content of different levels of granularity (software compression). All of these elements contribute

to determining the total "flow" through the tube. The first driver refers to growth in the number of connected devices (as measured by subscriptions). The second driver comes into play when telecommunication operators improve the transmission channels ("cables" and use of "wireless spectra"). The third driver stems from the fact that engineers find ways to send ever more information over the same kind of networks, using better compression algorithms. This section provides an estimate of the relative contribution of each identified factor to the surge in the world's telecommunication capacity.[25]

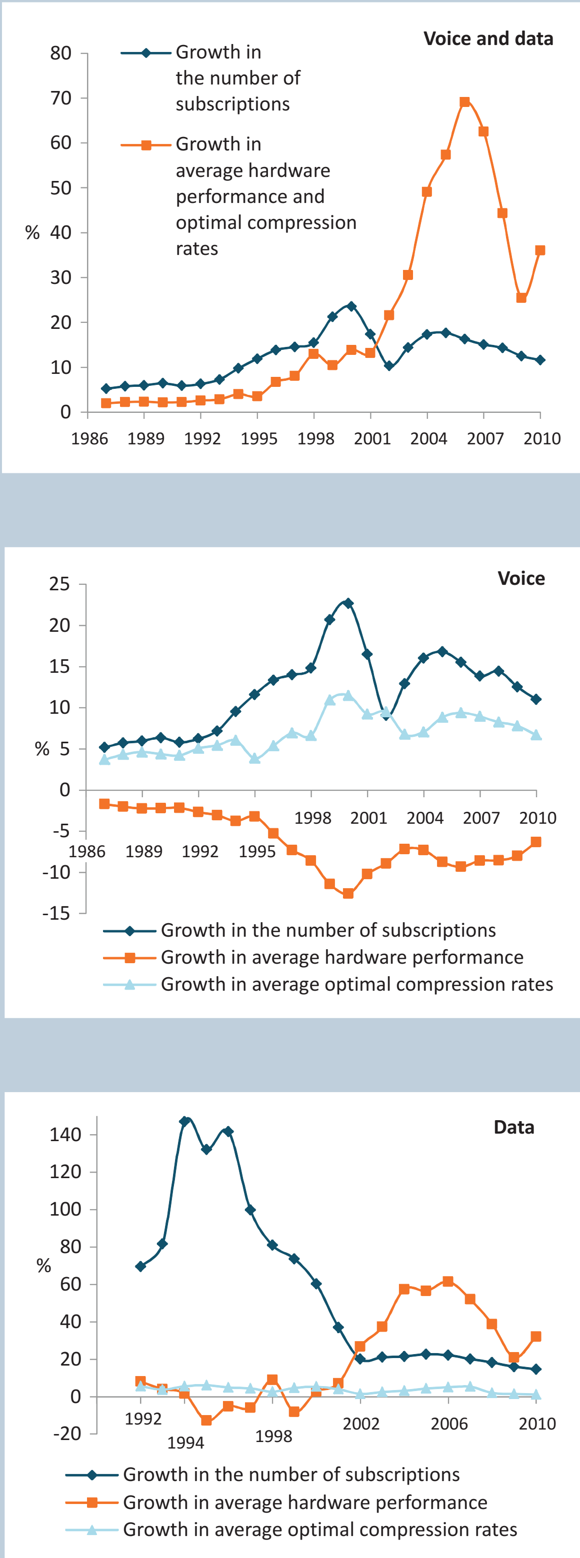
Until 2001, the main driver of the world's subscribed capacity in telecommunications was expansion in subscriptions: the world was flooded with additional devices, connected for example to mobile telephony and fixed Internet services (see Chart 5.5, upper graph). From 2001, the broadband revolution changed this pattern, and technological progress took over. Between 2005 and 2007, the introduction of FTTH/B and 3G mobile telephony resulted in an outstanding technological breakthrough: the average capacity in bits per subscription increased by more than 50 per cent. After the introduction of mobile-broadband technologies, the pace of technological progress abated somewhat. However, the rate of technological progress still remained three to four times higher than the growth in the number of subscriptions.

The middle and lower graphs in Chart 5.5 distinguish between subscribed capacity for voice and for data. Growth in the global subscribed capacity to communicate voice (middle) was mostly pushed by increases in numbers of subscriptions, while data communications (lower) were driven by technological change.

The average hardware capacity of voice subscriptions diminished over the period analysed, because mobile telephones have a lower average performance than fixed telephones. Improvements in compression algorithms contributed a fair share of total capacity growth (some 6 per cent yearly), mainly thanks to the new algorithms introduced with GSM or CDMA, without which the mobile revolution would not have been possible.

Growth in subscribed capacity for data was determined by different trends. At first, subscription numbers (commercial

Chart 5.5: Drivers of global subscribed telecommunication capacity, 1986-2010, annual growth rates



Source: ITU (2011e).

fixed Internet subscriptions and 2G sms-enabled mobile telephones) pushed global data capacity during the late 1990s. In the 2000s, however, growth in subscribed data capacity was fuelled by more advanced technology, not by additional subscriptions. Improvements in average hardware capacity per subscription were attributable to fixed-broadband Internet (DSL, cable modem and fibre optics). Therefore, at a time when data traffic is on the rise, changes in the global subscribed capacity are largely explained by technological progress (improved average hardware performance) and less by changes in the number of subscriptions.

The digital divide in terms of subscribed capacity in telecommunications

Estimates of subscribed capacity in telecommunications uncover another dimension of the international digital divide, otherwise commonly measured in terms of number of subscriptions.[26] Chart 5.6 provides a comparative analysis of the digital divide between developed and developing countries[27] in terms of subscriptions and of capacity. The order of magnitude[28] and evolution of the two divides are significantly different: the divide is larger and growing exponentially when measured in terms of subscribed capacity.

To simplify the analysis, traditional telephony services (voice and sms) are considered jointly with Internet services. This approach makes it possible to provide an estimate of total fixed and total mobile subscribed capacity in telecommunications, and to draw a comparison with the total number of subscriptions to fixed and to mobile telecommunications, respectively. A more comprehensive analysis of the digital divide in terms of subscriptions is provided in Chapter 2 of this report, which considers separately mobile-cellular, fixed-telephone, fixed-broadband and mobile-broadband subscriptions. For example, Chapter 2 shows that while the digital divide has narrowed in terms of mobile-cellular subscriptions, it has widened in terms of active mobile-broadband subscriptions.

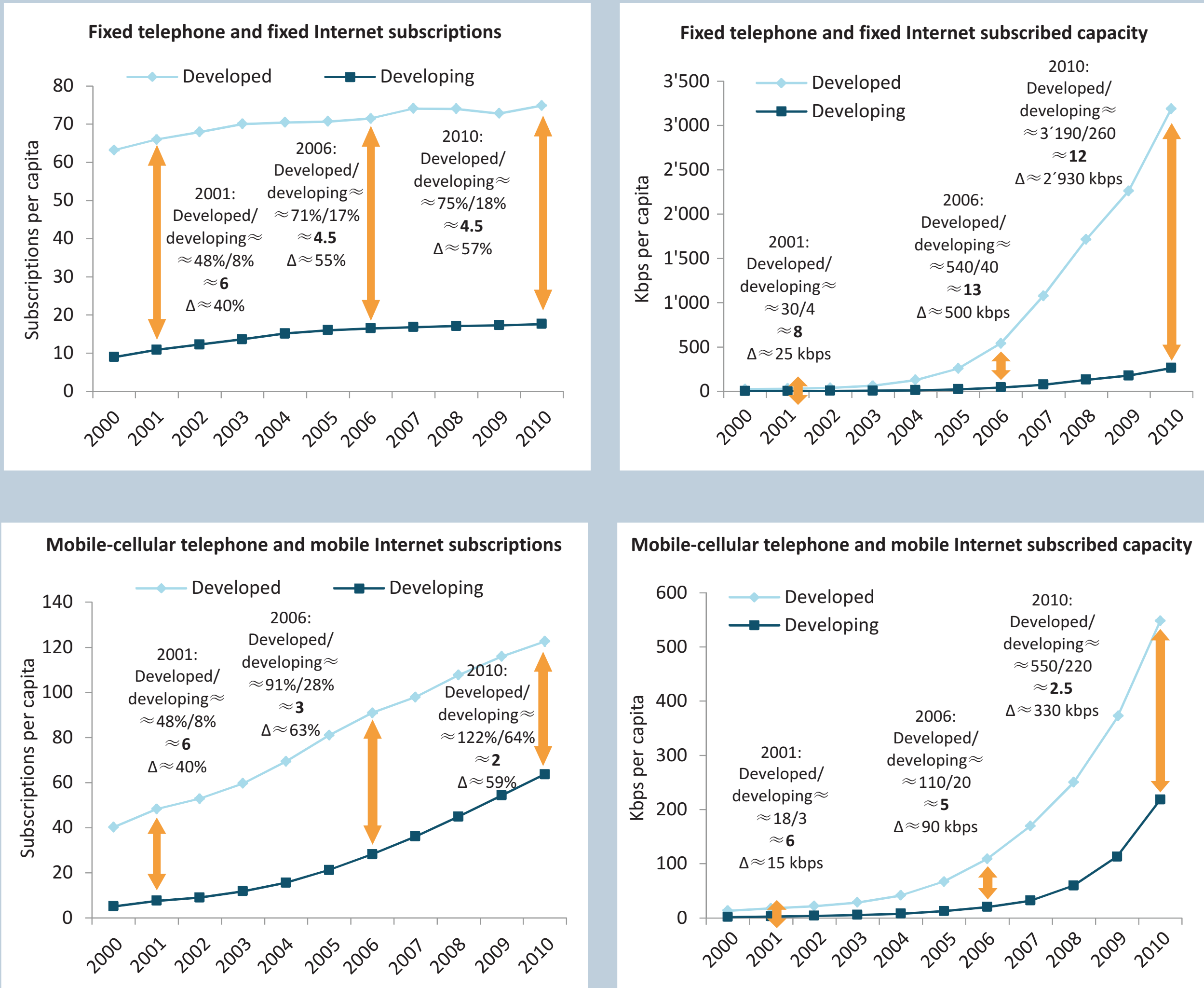
A comparison of the divides in fixed-line telecommunications (the upper graphs in Chart 5.6) shows that between 2006 and 2010 developing countries lagged behind developed countries in terms of both subscriptions and subscribed capacity. However, while the subscription divide was fairly constant (a difference of 55 to 57 subscriptions per 100 inhabitants), the gap in subscribed fixed capacity per capita increased markedly. In 2001, developed-country inhabitants enjoyed an average capacity of 30 kbit/s per capita, whereas in the developing countries the figure was a much lower 4 kbit/s per capita (a divide of roughly 8 to 1). In the first half of the last decade, the emergence of fixed broadband exacerbated the telecommunication capacity divide, while the divide in terms of the sum of fixed telephone and fixed Internet subscriptions narrowed somewhat. By 2010, developed countries attained an estimated capacity of 3 190 kbit/s per capita, as against only 260 kbit/s per capita for developing countries (a divide of roughly 12 to 1). By comparison, the fixed-line divide in terms of subscriptions appears to have stabilized at a ratio of approximately 4.5 to 1 (upper-left graph Chart 5.6). In absolute terms, the fixed-line capacity gap between developed and developing countries has grown exponentially, from a differential of 25 kbit/s per capita to 2 930 kbit/s per capita.

On the other hand, the divides in mobile telecommunications (the lower graphs in Chart 5.6) were less pronounced, essentially owing to the uptake on an unprecedented scale of mobile-cellular telephones in developing countries in the second half of the last decade. For mobile, even though in absolute terms the difference in subscribed capacity between the developed and developing countries increased from 15 kbit/s per capita in 2001 to 330 kbit/s per capita in 2010, the developing world caught up in relative terms: by 2010, subscribed mobile capacity per capita in developing countries was only 2.5 times smaller than in developed countries, as compared with six times smaller in 2001.

Comparing fixed and mobile subscribed capacities (the right hand upper and lower graphs in Chart 5.6) also yields additional insights. In 2010, developed countries enjoyed a fixed capacity per capita which was six times bigger than their subscribed mobile capacity (3 190 kbit/s vs 550 kbit/s, respectively). At the same time, subscribed mobile capacity per capita nearly equalled fixed subscribed capacity in developing countries (220 kbit/s per capita vs 260 kbit/s per capita, respectively). This means that, in terms of subscribed capacity, the average inhabitant of the developing world had almost as much bandwidth capacity available via mobile as via fixed networks.[29]

These findings call for a more refined analysis of the digital divide, one that considers several core variables and dimensions of the information society, including capacity to

Chart 5.6: Digital divides based on subscriptions in comparison with subscribed capacity



Source: ITU (2011e).
Note: Capacity is measured in optimally compressed kbit/s.

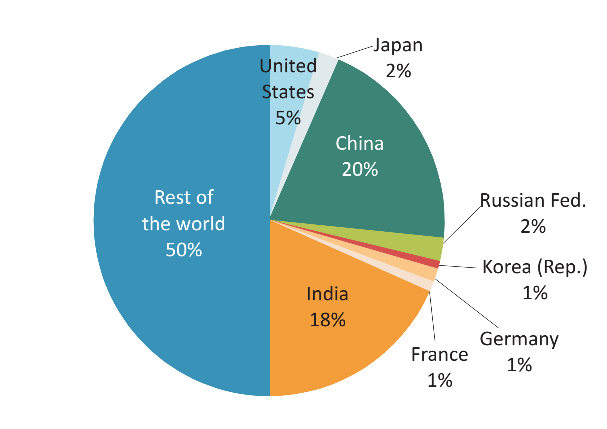
transmit information in bits and bytes over telecommunication networks, traffic data and network capacity.

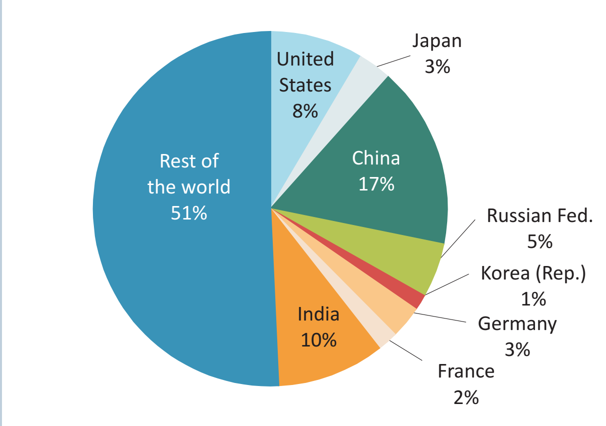
5.5 Comparative analysis of subscriptions, subscribed capacity, population and gross national income

This section presents country-level estimates for subscribed capacity in telecommunications, and draws a comparison with data on total number of telecommunication subscriptions, number of inhabitants and GNI.

First, eight selected countries are compared from four different perspectives: share in global population (Chart 5.7, left), share in total stock of telecommunication subscriptions (Chart 5.7, right), share in global GNI (Chart 5.8, left) and share in subscribed capacity in telecommunications (Chart 5.8, right). The eight selected countries represent approximately half of the world population. The comparison reveals that, for the selected countries, telecommunication subscription shares seem to correspond roughly to population shares. On the other hand, the proportions in terms of telecommunication capacity appear to follow the distribution of GNI. This suggests that the magnitude of the digital divide in subscriptions is smaller, and seems

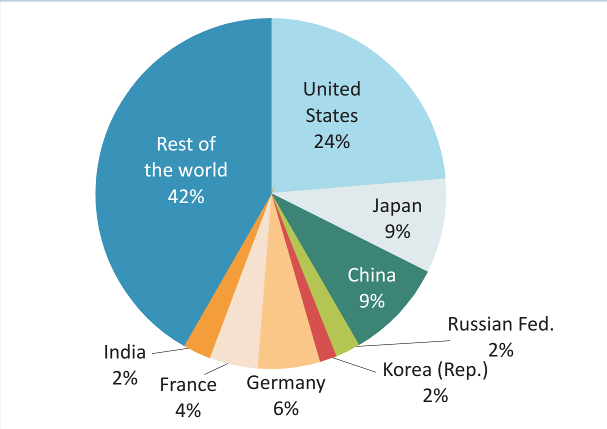
Chart 5.7: Global distribution of population (left) and telecommunication subscriptions (right), 2010

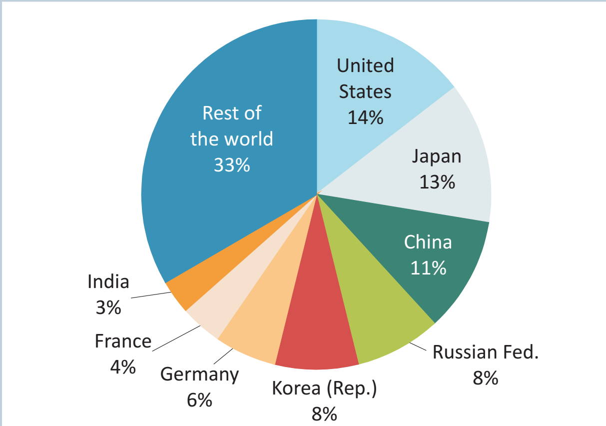




Source: ITU (2011e).
Note: Telecommunication subscriptions include fixed and mobile, voice and data subscriptions.

Chart 5.8: Global distribution of gross national income (left) and subscribed capacity (right), 2010





Source: ITU (2011e).
Note: Capacity is measured in optimally compressed kbit/s.

to correspond to the distribution of population between countries; whereas the divide in subscribed capacity is more pronounced and seems to resemble differences in terms of GNI.

In addition, subscribed capacity appears to be more unevenly distributed than income: in 2010, the eight selected countries (China, France, Germany, India, Japan, Republic of Korea, Russian Federation and United States) represented approximately 50 per cent of the world population and of global telecommunication subscriptions and 58 per cent of total global GNI, but 67 per cent of global subscribed capacity in telecommunications. These eight countries have the subscribed capacity to transmit and receive two out of every three bits in the world.

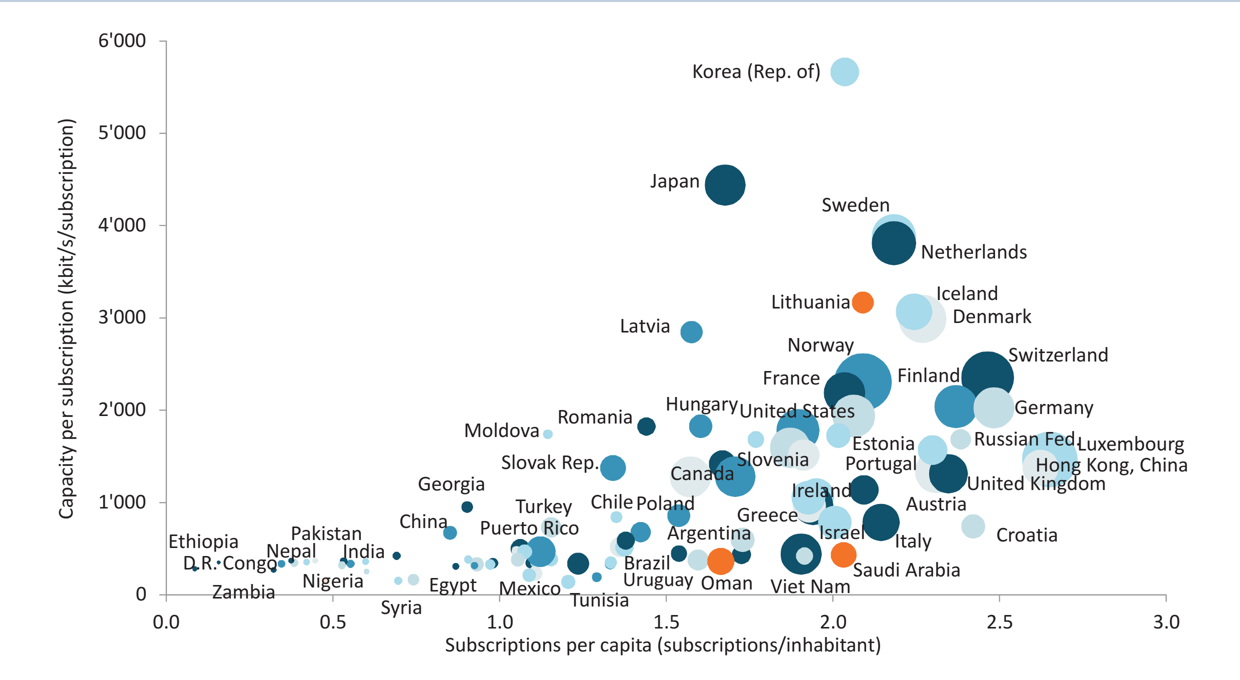
A number of the selected countries can be highlighted. When considering population and subscriptions, for example, the United States represents 5 per cent of the world population, but some 8 per cent of global subscriptions. Conversely,

India represents 18 per cent of the world population, but only 10 per cent of global telecommunication subscriptions. The picture changes (Chart 5.8), however, when looking at GNI and subscribed capacity shares: the United States earns 24 per cent of world income, but hosts only 14 per cent of global subscribed telecommunication capacity. India, on the other hand, accounts for 2 per cent of world income, but 3 per cent of global subscribed telecommunication capacity. Some countries, such as the Russian Federation and the Republic of Korea, have a much higher subscribed telecommunication capacity per dollar of GNI. Their share of global telecommunication capacity is four times larger than their share of global income.

A different comparison can be drawn (see Chart 5.9) between economies on the basis of subscriptions per capita (x-axis) and average subscribed capacity per subscription (y-axis). Chart 5.9 is revealing in several respects. First, more subscriptions (towards the right) and more capacity (towards the top) seem to be related to income (size of the bubbles). Second, subscription penetration rates and telecommunication capacity may not be linearly related. There appears to be a dynamic that follows an inverted L-shape. Economies first move from left to the right on the graph (increasing their level of penetration), until they reach a certain level of saturation. Having attained high telecommunication penetration rates, they then start to move upward on the graph, improving their average subscribed capacity with little change in penetration rates. This second part of the inverted L-shaped curve could be explained by technological change. The fact that in some countries there are relatively few new subscriptions does not imply that there is no increase in telecommunication capacity.

To illustrate the point made above, Lithuania, Oman and Saudi Arabia are highlighted in Chart 5.9. Saudi Arabia has more telecommunication subscriptions per capita than Oman, while both enjoy roughly the same average subscribed capacity in telecommunications (approximately 400 kbit/s per subscription). On the other hand, Lithuania has the same number of subscriptions per capita as Saudi Arabia (roughly

Chart 5.9: Two dimensions of the digital divide in telecommunications: subscriptions per capita and subscribed capacity per subscription, 2010



Source: ITU (2011e).
Note: Differences in blue shades are for illustrative purposes only. The size of the bubbles reflects GNI per capita. Included (in the analyses) are the 100 economies with the highest subscribed capacity in telecommunications.

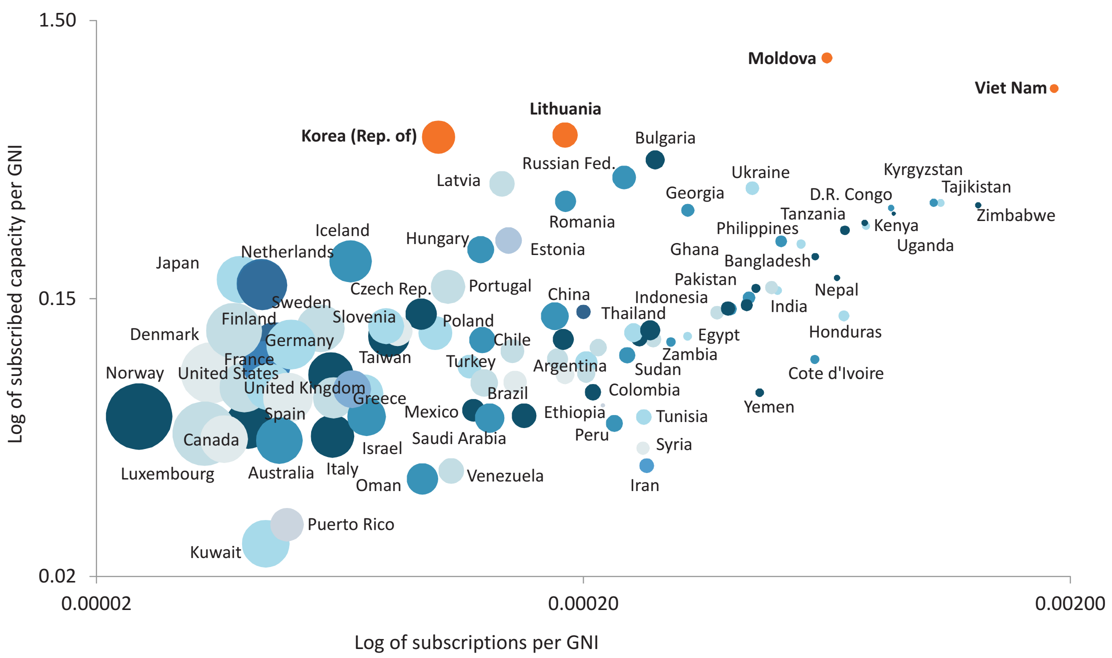
two subscriptions per inhabitant on average), but seven times more average capacity per subscription (over 3 Mbit/s). Oman has the highest income per capita of the three economies (USD 17 795 per capita), followed by Saudi Arabia (USD 15 816 per capita) and Lithuania (USD 11 385 per capita).

The Republic of Korea, which is often singled out as an illustration of best practice in broadband adoption (Rhee and Kim, 2004), attained one of the world's highest subscribed capacities per capita: some 11.5 optimally compressed Mbit/s per capita (the global average stood at 1 optimally compressed Mbit/s per capita, the developed-country average at 3.7 and the developing-country average at 0.5).

A different comparison can be drawn between performances in terms of penetration rates and subscribed capacity when controlling for the level of GNI per capita (Chart 5.10). The number of subscriptions per dollar of GNI (x-axis) provides a proxy for the proportion of income dedicated to expanding uptake through subscriptions. The subscribed capacity per dollar of GNI (y-axis) provides a measure of the proportion of income dedicated to rolling out more advanced infrastructure. The further to the right an economy is located on the graph, the more subscriptions it has per dollar of income; and the higher up it is located, the more telecommunication capacity it has per dollar of income.

Again, some countries stand out in terms of capacity, such as the Republic of Korea and Lithuania. Moldova and Viet Nam also stand out, despite having much lower income levels, in terms of both number of subscriptions and subscribed capacity per dollar of GNI. Both countries have started to deploy fibre-optic (FTTH/B) networks, and Viet Nam boasts a flourishing landscape of shared access. The chart also reveals that several African countries achieved remarkably high subscription penetration rates in relation to their GNI per capita (especially for mobile-cellular telephones). Examples are Côte d'Ivoire, Democratic Republic of Congo, Kenya, Uganda and Zimbabwe, which can be found well towards to the right of the chart. Similarly, several countries from Eastern Europe and the CIS have made significant strides towards upgrading their

Chart 5.10: Measuring the success of countries in expanding subscriptions (x-axis) and improving subscribed capacity (y-axis), controlling for GNI, 2010



Source: ITU (2011e).
Note: Differences in blue shades are for illustrative purposes only. The size of the bubbles reflects GNI per capita. Included are the 100 economies with the highest subscribed capacity in telecommunications.

subscribed capacity, such as Bulgaria, Georgia, Kyrgyzstan, Latvia, Lithuania, Romania, Russian Federation, Tajikistan and Ukraine (positioned in the upper half of the chart). Most developed countries appear clustered together in the lower left-hand corner of the chart. If developed countries achieved a telecommunication capacity per dollar of GNI equal to that of developing countries, they would be located much higher up in the chart. In other words, normalized for income, several developing countries obtain relatively high levels of telecommunication capacity, considering their low GNI per capita.

5.6 Conclusions and policy recommendations

This chapter has reviewed a methodology for measuring the capacity (subscribed and effective) to communicate in bits and bytes as a proxy for the capacity to communicate information. This approach provides new insights into the development of telecommunications, complementing studies based on number of subscriptions and amount of investment in infrastructure. Several conclusions can be drawn, with important consequences for research and policy.

Television broadcasting continues to dominate in terms of its share in global capacity to transmit data, accounting for more than 97 per cent of effectively communicated bits in 2007. However, the world's effective capacity in telecommunications has grown much faster than effective capacity in broadcasting. It is thus important to keep in mind the continuing dominance of TV in policies aimed at expanding network capacity for the provision of new services, such as digital television.

While the most widespread communication device is the mobile-cellular telephone, which in 2007 accounted for 29 per cent of all communication subscriptions (telecommunication and broadcasting), and 57 per cent of all telecommunication subscriptions, this chapter has shown that mobile telephony represents a much smaller, albeit rapidly growing, proportion of subscribed capacity in telecommunications, with a share of 16 per cent in 2007, and 25 per cent in 2010. Fixed Internet still accounts for the lion's share of total subscribed capacity in telecommunications (74 per cent in 2010).

The chapter has shown that, initially, the digital revolution was driven by subscription growth, but that in more recent years technological progress boosting average communication capacity was the main factor behind the increase in subscribed telecommunication capacity. Even though in many countries the growth of subscriptions per capita has slowed, the amount of subscribed capacity in telecommunications has grown at breakneck pace, expanding faster and faster, with a CAGR of 8 per cent between 1986 and 1993, 25 per cent between 1993 and 2000 and 55 per cent between 2000 and 2007.

In terms of both magnitude and evolution, the digital divide measured in kbit/s per capita differs from the divide measured in number of subscriptions. While subscriptions are more evenly distributed relative to population, subscribed telecommunication capacity is distributed along the lines of income inequality. Moreover, telecommunication capacity is even more concentrated than income. In 2010, eight countries (China, France, Germany, India, Japan, Republic of Korea, Russian Federation and United States) accounted for two-thirds of the world's telecommunication capacity. In this context, it is important to consider policies that address the capacity dimension of the digital divide, for example in national broadband plans.

In addition to measuring subscribed capacity, it would be desirable to obtain statistics on actual data traffic flows in order to measure effective capacity. This indicator would focus on the bits effectively communicated and would therefore require statistics on data traffic in backbone networks or direct measurements of data traffic. Some efforts are currently under way at ITU, through the work of the Expert Group on Telecommunication/ICT Indicators (EGTI), to revise the indicators and the methodology for collecting statistics on data traffic and backbone capacity.

The digital divide remains a complex reality. Each of the different statistical indicators used for measuring ICT help to shed light on a different aspect of the information society and a different dimension of the digital divide. While developing countries are currently registering higher growth in the uptake of mobile-cellular subscriptions, efforts should also be deployed to improve bandwidth and raise communication capacity. More and better statistics on

data traffic and network capacity can help inform policy-makers and shed more light on the capacity dimension of the digital divide.

The advantage of working with communication capacity is that it can be readily integrated into other studies on information capacity. The bit becomes a unifying variable enabling comparisons and aggregations across different kinds of communication technologies. In this sense, communication capacity can easily be related to additional attributes of interest concerning the technology itself (mobile or fixed; individual or shared; private or public; always-on or sporadic; etc.), as well as to additional socio-economic and demographic attributes of its users (education; income; gender; age; geographic location; etc.). Each of them will serve as a complementary input for policy from different perspectives, while at the same time focusing on the extent to which people are able to benefit from ICTs.

Endnotes

1 Usage is measured, for example, in household and population surveys (see ITU, 2011b, Chapter 5).

2 The Expert Group on Telecommunication/ICT Indicators (EGTI) was created in May 2009 with the mandate to revise the list of ITU supply-side indicators (i.e. data collected from operators), as well as to discuss outstanding methodological issues and new indicators. EGTI is open to all ITU members and experts in the field of ICT statistics and data collection. It works through an online discussion forum (http://www.itu.int/ITU-D/ict/ExpertGroup/default.asp) and face-to-face meetings. EGTI reports to the World Telecommunication/ICT Indicators meeting (WTIM).

3 Communication capacity and traffic are different but related concepts. Capacity determines from a supply-side perspective the amount of traffic per time unit that can be transmitted.

4 The details of all statistical sources (more than 500 different sources for telecommunications and broadcasting) and methodological work are published in Hilbert and López (2012c), available online at: http://www.martinhilbert.net/LopezHilbertSupportAppendix2012.pdf.

5 In 2011, there were 105 developed and developing economies with a mobile-cellular penetration rate of above 100 per cent.

6 See Monge and Matei (2004) and Lee et al (2007).

7 See Barnett, Chon and Rosen (2001) and Seo and Thorson (2012).

8 Examples of assessments of national traffic flows or broadband quality include, among others: Ministry of Internal Affairs and Communications of Japan (2007), Republic of Korea (2007), New Zealand Commerce Commission (2009), Ofcom (2010b), Federal Communications Commission (2011), European Commission (2011e).

9 Hilbert (2012) provides a comprehensive review of these studies. Influential studies include: Ito (1981), Pool (1983), Lyman, et al (2003), Bohn and Short (2009), Cisco (2011).

10 See, for example, Mediascope Europe 2010, *The European Media Landscape Report*, available at: http://www.iabeurope.eu/media/53821/european%20media%20landscape%20report%20summary.pdf.

11 Ookla, NetIndex source data, 2011: http://www.netindex.com/source-data/. NetIndex compiles the results of two bandwidth speed tests (Speedtest.net and Pingtest.net) and thereby estimates the average upstream and downstream speed for countries worldwide since 1 January 2008 (for 2008, a daily average of 84 671 tests per country for 128 countries; for 2009, a daily average of 129 852 tests per country for 150 countries; for 2010, a daily average of 179 822 tests per country for 160 countries). These statistics have their limitations, but they are "the best of the currently available data sources for assessing the speed of ISP's broadband access service" across many different countries (Bauer, Clark and Lehr, 2010). For more on the details of our methodology, see the reference in endnote 4.

12 The two technologies both sample voice (e.g. GSM-AMR 2G for mobile telephony and Law-A or Law-Mu for fixed), but each converts it into a different amount of bits. Using another (more efficient) compression algorithm (like Speech Profile of MPEG 4), the same information content of a fixed telephone can be compressed down to some 12 kbit/s without loss of quality.

13 Maintaining voice at an adequate quality (mean opinion score (MOS) quality between 3.6 and 4.1).

14 Information based on a research study with data collected from Chile, Colombia, Cyprus, Czech Republic, Italy, Macao (China), Mexico, Portugal, Sweden and the United States.

15 Measuring consumption is difficult, since it depends on the speed and intensity of consumption. For example, people might read at different speeds and with different levels of attention (comprehension), which implies the need for psychological measures. The assessment here focuses exclusively on measuring the technological capacity.

16 For radio and television, the study uses a combination of statistical indicators such as the number of radio sets per 100 inhabitants, the number of TV sets per 100 inhabitants and the number of cable, satellite and digital TV subscriptions.

17 See endnote 4 above.

18 The recent increase in the use of social media over the Internet is not reflected in these calculations.

19 For comparisons with other technologies, see: M. Hilbert, *That giant sifting sound*, The Economist, 2011, at: https://www.youtube.com/watch?v=iIKPjOuwqHo.

20 Up to 2007, most mobile data traffic consisted of sms (short message service) and mms (multimedia messaging service) messages, with some occasional wireless application protocol (WAP) services, while surfing the Internet on mobile-cellular telephones was still incipient.

21 This is equivalent to assuming that all telecommunication technologies are used with the same intensity in the different countries. This assumption is not too unreasonable when analysing telecommunications by itself (instead of mixing it with broadcasting, which — as seen above — has quite distinct usage intensities).

22 This observation has to be qualified by the inherent differences in the architectures of telephone and Internet networks. In traditional media networks, the user requires an equal amount of upstream and downstream capacity to get a message equally disseminated (sending a message to one user at a time). In digital networks, an imbalance between upstream and downstream does not necessarily mean that the message does not get equally disseminated (uploaded once, the same content can be downloaded by or copied to many different users simultaneously).

23 See Prime Minister of Japan and his Cabinet Kantei (2001a), *e-Japan Strategy*. Government of Japan, 22 January, 2001, at http://www.kantei.go.jp/foreign/it/network/0122full_e.html, and Prime Minister of Japan and his Cabinet Kantei (2001b), *e-Japan Priority Policy Programme*. Government of Japan, 29 March, 2001, at http://www.kantei.go.jp/foreign/it/network/priority-all/index.html.

24 From a demand-side perspective, Cisco (2011) suggested that a key growth factor for network capacity is the increasing richness of media content.

[25] The following formula has been used: [Growth factor of global capacity to telecommunicate] = [growth factor of subscriptions] * [growth factor of technological progress for hardware] * [growth factor of technological progress for compression algorithms]. For an in-depth analysis of the different drivers, see Hilbert (forthcoming).

[26] For a discussion of the different definitions of the digital divide and the respective complementary policy goals, see Hilbert (2011). Hilbert, López and Vasquez (2010) measure the digital divide in terms of hardware capacity.

[27] Developed and developing countries were classified according to the UN M.49 standard: http://www.itu.int/ITU-D/ict/definitions/regions/.

[28] In absolute terms.

[29] These relationships may be expected to be different when considering effective capacity as opposed to subscribed capacity.

[30] When taking into account the 172 countries and territories for which data were available in 2010, the correlation coefficient between country shares in global population and country shares in total stock of telecommunication subscriptions was 0.92. The correlation coefficient between country shares in subscribed capacity in telecommunications and country shares in global GNI was 0.87.

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Annex 1. ICT Development Index (IDI) methodology

This annex outlines the methodology used to compute the IDI, and provides more details on various steps involved, such as the indicators included in the index and their definition, the imputation of missing values, the normalization procedure, the weights applied to the indicators and sub-indices, and the results of the sensitivity analysis.

1. Indicators included in the IDI

The selection of indicators was based on certain criteria, including relevance for the index objectives, data availability and the results of various statistical analyses such as the principal component analysis (PCA).[1] The following 11 indicators are included in the IDI (grouped by the three sub-indices: access, use, and skills).

a) ICT infrastructure and access indicators

Indicators included in this group provide an indication of the available ICT infrastructure and individuals' access to basic ICTs. Data for all of these indicators are collected by ITU.[2]

1. Fixed-telephone subscriptions per 100 inhabitants

Fixed-telephone subscriptions refers to the sum of active analogue fixed-telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones. It includes all accesses over fixed infrastructure supporting voice telephony using copper wire, voice services using Internet Protocol (IP) delivered over fixed (wired)-broadband infrastructure (e.g. DSL, fibre optic), and voice services provided over coaxial-cable television networks (cable modem). It also includes fixed wireless local loop (WLL) connections, which are defined as services provided by licensed fixed-line telephone operators that provide last-mile access to the subscriber using radio technology, when the call is then routed over a fixed-line telephone network (and not a mobile-cellular network). In the case of VoIP, it refers to subscriptions that offer the ability to place and receive calls at any time and do not require a computer. VoIP is also known as voice-over-broadband (VoB), and includes subscriptions through fixed-wireless, DSL, cable, fibre-optic and other fixed-broadband platforms that provide fixed telephony using IP.

2. Mobile-cellular telephone subscriptions per 100 inhabitants

Mobile-cellular telephone subscriptions refers to the number of subscriptions to a public mobile-telephone service which provides access to the public switched telephone network (PSTN) using cellular technology. It includes both the number of postpaid subscriptions and the number of active prepaid accounts (i.e. that have been active during the past three months). It includes all mobile-cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services.

Given the rapid growth in the number of mobile-cellular subscriptions, it would be useful to distinguish between the number of mobile subscriptions and the number of individuals using a mobile phone. Although the latter

indicator would be more appropriate for inclusion in the IDI, few countries currently collect this information through household surveys.[3] As more data become available, the number of mobile-phone users should eventually replace the number of mobile subscriptions in the index.

3. International Internet bandwidth (bit/s) per Internet user

International Internet bandwidth refers to the total used capacity of international Internet bandwidth, in megabits per second (Mbit/s). It is measured as the sum of used capacity of all Internet exchanges offering international bandwidth. If capacity is asymmetric, then the incoming capacity is used. The data compiled by ITU from responses received from countries through its annual questionnaire were supplemented with data from ITU research.

4. Percentage of households with a computer

A *computer* refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities, such as mobile-cellular phones, personal digital assistants or TV sets.

There are certain data limits to this indicator, insofar as estimates have to be calculated for many developing countries which do not yet collect ICT household statistics (see below on missing data). Over time, as more data become available, the quality of the indicator will improve.

5. Percentage of households with Internet access

The *Internet* is a worldwide public computer network. It provides access to a number of communication services, including the World Wide Web, and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only a computer – it may also be mobile phone, games machine, digital TV, etc.). Access can be via a fixed or mobile network.

There are certain data limits to this indicator, insofar as estimates have to be calculated for many developing countries which are do yet collect ICT household statistics (see below on missing data). Over time, as more data become available, the quality of the indicator will improve.

b) ICT use indicators

The indicators included in this group capture ICT intensity and usage. Data for all of these indicators are collected by ITU.[4]

1. Percentage of individuals using the Internet

The *percentage of individuals using the Internet* indicator is based on results from national household surveys. Today, most developed and larger developing countries collect data on the number of Internet users through official household surveys. Data are either provided directly to ITU by national statistical offices (NSO), or ITU carries out the necessary research to obtain them, for example from NSO websites.

For countries that do not include Internet usage questions in national household surveys, ITU estimated the percentage of individuals using the Internet on the basis of a model that includes covariate indicators such as fixed-telephone subscriptions, fixed-broadband subscriptions, active mobile-broadband subscriptions and GNI per capita. As a result, the actual number of users is usually less accurately measured in developing economies where data are not available. In the future, an increasing number of household surveys will include questions on Internet usage, and this will help improve the data availability and quality.

2. Fixed (wired)-broadband subscriptions per 100 inhabitants

Fixed (wired)-broadband subscriptions refers to the number of subscriptions for high-speed access to the public Internet (a TCP/IP connection). High-speed access is defined as downstream speeds equal to, or greater than, 256 kbit/s. Fixed (wired) broadband includes cable modem, DSL, fibre and other fixed (wired)-broadband technologies (such as Ethernet LAN, and broadband-over-powerline (BPL) communications). Subscriptions with access to data communications (including the Internet) via mobile-cellular networks are excluded.

3. Active mobile-broadband subscriptions per 100 inhabitants

Active mobile-broadband subscriptions refers to the sum of standard mobile-broadband subscriptions and dedicated

mobile-broadband subscriptions to the public Internet. It covers actual subscribers, not potential subscribers, even though the latter may have broadband-enabled handsets.

- *Standard mobile-broadband subscriptions* refers to active mobile-cellular subscriptions with advertised data speeds of 256 kbit/s or greater that allow access to the greater Internet via HTTP and which have been used to set up an Internet data connection using Internet Protocol (IP) in the past three months. Standard sms and mms messaging do not count as an active Internet data connection, even if the messages are delivered via IP.

- *Dedicated mobile-broadband data subscriptions* refers to subscriptions to dedicated data services (over a mobile network) that allow access to the greater Internet and which are purchased separately from voice services, either as a standalone service (e.g. using a data card such as a USB modem/dongle) or as an add-on data package to voice services which requires an additional subscription. All dedicated mobile-broadband subscriptions with recurring subscription fees are included regardless of actual use. Prepaid mobile-broadband plans require use if there is no monthly subscription. This indicator could also include mobile WiMAX subscriptions.

ITU began gathering data on active mobile-broadband subscriptions in 2010, and a growing number of countries are reporting data for this indicator. As more accurate data become available, countries have provided ITU with revised 2010 values for the "active mobile-broadband subscriptions" indicator. In the previous edition of this report, data were sourced from Wireless Intelligence.

c) ICT skills indicators

Data on adult literacy rates and gross secondary and tertiary enrolment ratios are collected by the UNESCO Institute for Statistics (UIS).

1. Adult literacy rate

According to UIS, the "*Adult literacy rate* is defined as the percentage of population aged 15 years and over who can both read and write with understanding a short simple statement on his/her everyday life. Generally, 'literacy' also encompasses 'numeracy', the ability to make simple arithmetic calculations. The main purpose of this indicator is to show the accumulated achievement of primary education and literacy programmes in imparting basic literacy skills to the population, thereby enabling them to apply such skills in daily life and to continue learning and communicating using the written word. Literacy represents a potential for further intellectual growth and contribution to economic-socio-cultural development of society."[5]

2. Gross enrolment ratio (secondary and tertiary level)

According to UIS, "The *gross enrolment ratio* is the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school-year."

2. Imputation of missing data

A critical step in the construction of the index is to create a complete data set, without missing values. There are several imputation techniques that can be applied to estimate missing data.[6] Each of the imputation techniques, like any other method employed in the process, has its own strengths and weaknesses. The most important consideration is to ensure that the imputed data will reflect a country's actual level of ICT access, usage and skills.

Given that ICT access and usage are both correlated with national income, hot-deck imputation was chosen as the method for estimating the missing data. Hot-deck imputation uses data from countries with "similar" characteristics. GDP per capita and geographic location were used as the main criteria in identifying countries with similar characteristics. For example, missing data for country A were estimated for a certain indicator by first identifying the countries that have similar levels of GDP per capita and that are from the same region. Then, the indicator that has a known relationship to the indicator to be estimated was considered. For instance, fixed (wired)-broadband subscription data of country A was estimated by using fixed (wired)-broadband subscription data of country B from the same region with similar level of GDP per capita and similar level of Internet subscriptions. The

same logic was applied to estimate missing data for all indicators included in the index.

3. Normalization of data

Normalization of the data is necessary before any aggregation can be made in order to ensure that the data set uses the same unit of measurement. For the indicators selected for the construction of the IDI, it is important to transform the values to the same unit of measurement, since some of them are expressed as a percentage of the population or of households, whereby the maximum value is 100, while other indicators (although also expressed as a percentage) can have values exceeding 100, such as mobile-cellular subscriptions or international Internet bandwidth.

There are certain particularities that need to be taken into consideration when selecting the normalization method for the IDI. For example, in order to identify the digital divide, it is important to measure the *relative* performance of countries (i.e. divide among countries). Second, the normalization procedure should produce index results that allow countries to track progress of their evolution towards an information society over time.

A further important criterion for the selection of the normalization method was to choose one that can be replicated by countries. Indeed, some countries have shown a strong interest in applying the index methodology at the national or regional level. Therefore, certain methods cannot be applied, for example those that rely on the values of other countries, which might not be available to users.

For the IDI, the *distance to a reference measure* was used as the normalization method. The reference measure is the ideal value that could be reached for each variable (similar to a goalpost). In all of the indicators chosen, this will be 100, except for four indicators:

- International Internet bandwidth per Internet user, which in 2011 ranges from 89 (bits/s/user) to almost 965 000. To diminish the effect of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value was then computed by adding two standard deviations to the mean of the rescaled values, resulting in a log value of 5.61.

- Mobile-cellular subscriptions, which in 2011 range from 2.6 to 243.5 per 100 inhabitants. The ideal value was computed using the same methodology as used for the bandwidth data, by adding two standard deviations to the mean. The resulting reference value was 180 subscriptions per 100 inhabitants.

- Fixed-telephone subscriptions per 100 inhabitants, which range from 0.05 to 63 in 2011. The same methodology was used to compute the reference value, resulting in a rounded value of 60 per 100 inhabitants.

- Fixed (wired)-broadband subscriptions per 100 inhabitants. This is a fairly recent indicator and values range from zero to 39 per 100 inhabitants in 2011. In line with fixed-telephone subscriptions, the ideal value was defined at 60 per 100 inhabitants.

After normalizing the data, the individual series were all rescaled to identical ranges, from 1 to 10. This was necessary in order to compare the values of the indicators and the sub-indices.

4. Weighting and aggregation

The indicators and sub-indices included in the IDI were weighted based on the PCA results obtained when the index was first computed.[7] Annex Box 1.1 presents the weights for the indicators and sub-indices.

5. Calculating the IDI

Sub-indices were computed by summing the weighted values of the indicators included in the respective subgroup.

- *ICT access* is measured by fixed-telephone subscriptions per 100 inhabitants, mobile-cellular subscriptions per 100 inhabitants, international Internet bandwidth per Internet user, percentage of households with a computer and percentage of households with Internet access.

Annex Box 1.1: Weights used for indicators and sub-indices included in the IDI

	Weights (Indicators)	Weights (Sub-index)
ICT access		
Fixed-telephone subscriptions per 100 inhabitants	0.20	0.40
Mobile-cellular telephone subscriptions per 100 inhabitants	0.20	
International Internet bandwidth per Internet user	0.20	
Percentage of households with a computer	0.20	
Percentage of households with Internet access	0.20	
ICT use		
Percentage of individuals using the Internet	0.33	0.40
Fixed (wired)-broadband subscriptions per 100 inhabitants	0.33	
Active mobile-broadband subscriptions per 100 inhabitants	0.33	
ICT skills		
Adult literacy rate	0.33	0.20
Secondary gross enrolment ratio	0.33	
Tertiary gross enrolment ratio	0.33	

Source: ITU.

- *ICT use* is measured by percentage of individuals using the Internet, fixed (wired)-broadband subscriptions per 100 inhabitants and active mobile-broadband subscriptions per 100 inhabitants.

- *ICT skills* are approximated by adult literacy rate, secondary gross enrolment ratio and tertiary gross enrolment ratio.

The values of the sub-indices were calculated first by normalizing the indicators included in each sub-index in order to obtain the same unit of measurement. The reference values applied in the normalization were discussed above. The sub-index value was calculated by taking the simple average (using equal weights) of the normalized indicator values.

For computation of the final index, the ICT access and ICT use sub-indices were given 40 per cent weight each, and the skills sub-index (because it is based on proxy indicators) 20 per cent weight. The final index value was then computed by summing the weighted sub-indices. Annex Box 1.1 illustrates the process of computing the IDI for the Republic of Korea (which tops the IDI 2011).

6. Sensitivity analysis

Sensitivity analysis was carried out to investigate the robustness of the index results, in terms of the relative position in the overall ranking, using different combinations of methods and techniques to compute the index.

Potential sources of variation or uncertainty can be attributed to different processes employed in the computation of the index, including the selection of individual indicators, the imputation of missing values and the normalization, weighting and aggregation of the data.

Each of the processes or combination of processes affects the IDI value. A number of tests were carried out to examine the robustness of the IDI results (rather than the actual values). The tests computed the possible index values and country rankings for different combinations of the processes mentioned above. Results show that, while the computed index values change, the message remains the same. The IDI was found to be extremely robust to different methodologies – with the exception of some countries, particularly countries in the "high" group.

Annex Box 1.2: Example of how to calculate the IDI value

	KOREA (REP.)			
	Indicators	**Ideal value***		**2011**
	ICT access			
a	Fixed-telephone subscriptions per 100 inhabitants	60		60.9
b	Mobile-cellular telephone subscriptions per 100 inhabitants	180		108.5
c	International Internet bandwidth per Internet user**	408'813		17'170
d	Percentage of households with a computer	100		81.9
e	Percentage of households with Internet access	100		97.2
	ICT use			
f	Percentage of individuals using the Internet	100		83.8
g	Fixed (wired)-broadband Internet subscriptions per 100 inhabitants	60		36.9
h	Active mobile-broadband subscriptions per 100 inhabitants	100		105.1
	ICT skills			
i	Adult literary rate	100		97.1
j	Secondary gross enrolment ratio	100		103.9
k	Tertiary gross enrolment ratio	100		99.0
	Normalized values			
	ICT access	**Formula**	**Weight**	
z1	Fixed-telephone subscriptions per 100 inhabitants	a/60	0.20	1.00
z2	Mobile-cellular telephone subscriptions per 100 inhabitants	b/180	0.20	0.60
z3	International Internet bandwidth per Internet user	log(c)/5.61	0.20	0.75
z4	Percentage of households with a computer	d/100	0.20	0.82
z5	Percentage of households with Internet access	e/100	0.20	0.97
	ICT use			
z6	Percentage of individuals using the Internet	f/100	0.33	0.84
z7	Fixed (wired)-broadband subscriptions per 100 inhabitants	g/60	0.33	0.62
z8	Active mobile-broadband subscriptions per 100 inhabitants	h/100	0.33	1.00
	ICT skills			
z9	Adult literary rate	i/100	0.33	0.97
z10	Secondary gross enrolment ratio	j/100	0.33	1.00
z11	Tertiary gross enrolment ratio	k/100	0.33	0.99
	Sub-indices			
	IDI access sub-index (L)	**y1+y2+y3+y4+y5**	**0.40**	**0.83**
y1	Fixed-telephone subsriptions per 100 inhabitants	Z1*.20		0.20
y2	Mobile-cellular telephone subscriptions per 100 inhabitants	Z2*.20		0.12
y3	International Internet bandwidth per Internet user	Z3*.20		0.15
y4	Percentage of households with a computer	Z4*.20		0.16
y5	Percentage of households with Internet access	Z5*.20		0.19
	IDI use sub-index (M)	**y6+y7+y8**	**0.40**	**0.82**
y6	Percentage of individuals using the Internet	Z6*.33		0.28
y7	Fixed (wired)-broadband subscriptions per 100 inhabitants	Z7*.33		0.21
y8	Active mobile-broadband subscriptions per 100 inhabitants	Z8*.33		0.33
	IDI skills sub-index (N)	**y9+y10+y11**	**0.20**	**0.98**
y9	Adult literary rate	Z9*.33		0.32
y10	Secondary gross enrolment ratio	Z10*.33		0.33
y11	Tertiary gross enrolment ratio	Z11*.33		0.33
IDI	**ICT Development Index**	**((L*.40)+(M*.40)+(N*.20))*10**		**8.56**

Source: ITU.

Note: * The ideal value was computed by adding two standard deviations to the mean value of the indicator.
** To diminish the effect of the large number of outliers at the high end of the value scale, the data were first transformed to a logarithmic (log) scale. The ideal value of 408'813 bit/s per Internet user is equivalent to 5.61 if transformed to a log scale.

The relative position of countries included in the "high" group (see Chapter 2) can change depending on the methodology used. Therefore, caution should be exercised when drawing conclusions based on the ranking of these countries. However, the relative position of countries included in the "low" group is in no way affected by the methods or techniques used, and the countries in this group ranked low in all index computations using different methodologies. This confirms the results conveyed by the IDI.

Endnotes

1 Principal component analysis was used to examine the underlying nature of the data. A more detailed description of the analysis is available in the Annex 1 ITU (2009a).

2 More information about the indicators is available in the ITU 'Handbook for the collection of administrative data on telecommunications/ICT' 2011, see ITU (2011a).

3 In the 2011 ITU data-collection survey, 59 economies reported data for this indicator.

4 See endnote 2.

5 UIS 'Education Indicators: Technical Guidelines', see http://www.uis.unesco.org/ev.php?ID=5202_201&ID2=DO_TOPIC.

6 See OECD and European Commission (2008).

7 For more details, see Annex 1 to ITU (2009a).

Annex 2. ICT Price Basket (IPB) methodology

Price data collection and sources

The 2011 ICT Price Basket (IPB) is based on prices collected in the third and fourth quarters of 2011. The data were collected through the *ITU ICT Price Basket questionnaire*, which was sent to the administrations and statistical contacts of all ITU Member States in October 2011. Through the questionnaire, contacts were requested to provide 2011 data, and the 2009 and 2010 prices were included for reference. For those countries that did not reply, prices were collected directly from operators' websites and/or through direct correspondence. Prices were collected from the operator with the largest market share, as measured by the number of subscriptions. Insofar as, for many countries, it is not clear which Internet service provider (ISP) has the dominant market share, preference was given to prices offered by the (former) incumbent telecommunication operator. In some cases, especially when prices were not clearly advertised or were described only in the local language, and when operators did not respond to queries, alternative operators were chosen. All prices were converted into USD using the average annual UN operational rate of exchange and into PPP$ using World Bank conversion factors. Prices for 2008, 2009 and 2010, which are also shown and used in this chapter, were collected in previous years (always during the second half of the respective year), in national currencies, and converted using the annual UN operational rates of exchange.

The fixed telephone sub-basket

The fixed-telephone sub-basket refers to the monthly price charged for subscribing to the public switched telephone network (PSTN), plus the cost of 30 three-minute local calls to the same (fixed) network (15 peak and 15 off-peak calls). It is calculated as a percentage of a country's average monthly GNI per capita, and also presented in USD and PPP$.

The fixed-telephone sub-basket does not take into consideration the one-time connection charge. This choice has been made in order to improve comparability with the other sub-baskets, which include only recurring monthly charges. If the monthly subscription includes free calls/minutes, then these are taken into consideration and deducted from the total cost of the fixed-telephone sub-basket.

The cost of a three-minute local call refers to the cost of a three-minute call within the same exchange area (local call) using the subscriber's equipment (i.e. not from a public telephone). It thus refers to the amount the subscriber must pay for a three-minute call, and not the average price for each three-minute interval. For example, some operators charge a one-time connection fee for every call, or a different price for the first minute of a call. In such cases, the actual amount for the first three minutes of a call is calculated. Many operators indicate whether advertised prices include taxes or not. If they are not included, taxes are added to the sub-basket, so as to improve the comparability of prices between countries.[1] The sub-basket does not take into consideration the price of a telephone set (see Box Annex 2.1).

The ICT Price Basket includes a sub-basket for fixed telephony because fixed-telephone access remains an

Box Annex 2.1: Rules applied in collecting fixed-telephone prices

1. The prices of the operator with the largest market share (measured by the number of subscriptions) are used.
2. Prices include taxes.[2]
3. Prices are reported and collected in national currency and then converted to USD and PPP$.
4. Where the operator proposes different commitment periods, the 12-month plan (or the one closest to this commitment period) is used.
5. If prices vary between different regions of the country, prices refer to those applied in the largest city (in terms of population) or in the capital city.
6. The same price plan applies across all the indicators. For example, if a given Plan A is used for the fixed-telephone service, the elements in Plan A are also used for the monthly subscription and the local-call charges.
7. Local calls refer to those made on the same fixed network (on-net) within the same exchange area.
8. Prices refer to a regular (non-promotional) plan and exclude promotional offers, limited discounts or options such as special prices to certain numbers.
9. Peak is the busiest time of the day, usually during working hours of weekdays. If there are different peak prices, the most expensive one during the daytime is used.
10. If there are different off-peak prices, then the one that is the cheapest before midnight is used. If the only off-peak period is after midnight (valid during the night), then this is not used. Instead, the peak rate is used.
11. If no distinction is made between peak and off-peak prices, then the same price is used for the peak and off-peak indicators.
12. With convergence, operators are increasingly providing multiple (bundled) services, such as voice telephony, Internet access and television reception, over their networks. They often bundle these offers into a single subscription. This can present a challenge for data collection, since it may not be possible to isolate the prices for one service. It is preferable to use prices for a specific service; but if this is not possible, then the additional services that are included in the price are specified in a note.

important access technology in its own right in a large number of countries. Additionally, the conventional fixed-telephone line is used not only for dial-up Internet access, but also as a basis for upgrading to DSL broadband technology, which in 2011 still accounted for the majority of all fixed-broadband subscriptions. While more and more countries are moving away from narrowband/dial-up Internet access to broadband, dial-up Internet access still remains the only Internet access available to some people in developing countries. Since the IPB does not include dial-up (but only broadband) prices, and since dial-up Internet access requires users to subscribe to a fixed-telephone line, the fixed-telephone sub-basket can be considered as an indication for the price of dial-up Internet access.

The mobile-cellular sub-basket

The mobile-cellular sub-basket refers to the price of a standard basket of mobile monthly usage for 30 outgoing calls per month (on-net, off-net to a fixed line and for peak and off-peak times) in predetermined ratios, plus 100 sms messages. It is calculated as a percentage of a country's average monthly GNI per capita, and also presented in USD and PPP$. The mobile-cellular sub-basket is based on prepaid prices, although postpaid prices are used for countries where prepaid subscriptions make up less than 2 per cent of all mobile-cellular subscriptions.

The mobile-cellular sub-basket is largely based on, but does not entirely follow, the 2009 methodology of the

OECD low-user basket, which is the entry-level basket with the smallest number of calls included (OECD, 2010b). Unlike the 2009 OECD methodology, which is based on the prices of the two largest mobile operators, the ITU mobile sub-basket uses only the largest mobile operator's prices. Additionally, the ITU mobile-cellular sub-basket does not take into account calls to voicemail (which in the OECD basket represent 4 per cent of all calls), nor non-recurring charges, such as the one-time charge for a SIM card. The basket gives the price of a standard basket of mobile monthly usage in USD determined by the OECD for 30 outgoing calls per month in predetermined ratios plus 100 sms messages.[3] The cost of national sms is the charge to the consumer for sending a single sms text message. Both on-net and off-net sms prices are taken into account. The basket considers on-net and off-net calls as well as calls to a fixed telephone[4] and, since the price of calls often depends on the time of day or week it is made, peak, off-peak and weekend periods are also taken into consideration. The call distribution is outlined in Annex Table 2.1.

Prepaid prices were chosen because they are often the only payment method available to low-income users, who might not have a regular income and will thus not qualify for a postpaid subscription. Rather than reflecting the cheapest option available, the mobile-cellular sub-basket therefore corresponds to a basic, representative (low-usage) package available to all customers. In countries where no prepaid offers are available, the monthly fixed cost (minus the free minutes of calls included, if applicable) of a postpaid subscription is added to the basket. To make prices comparable, a number of rules are applied (Annex Box 2.2).

The fixed-broadband sub-basket

The fixed-broadband sub-basket refers to the price of a monthly subscription to an entry-level fixed-broadband plan. It is calculated as a percentage of a country's average monthly GNI per capita, and also presented in USD and PPP$. For comparability reasons, the fixed-broadband sub-basket is based on a monthly data usage of (a minimum of) 1 Gigabyte (GB). For plans that limit the monthly amount of data transferred by including data volume caps below 1 GB, the cost for the additional bytes is added to the sub-basket. The minimum speed of a broadband connection is 256 kbit/s.

Where several offers are available, preference is given to the cheapest available connection that offers a speed of at least 256 kbit/s and 1 GB of data volume. If providers set a limit of less than 1 GB on the amount of data that can be transferred within a month, then the price per additional byte is added to the monthly price so as to calculate the cost of 1 GB of

Annex Table 2.1: OECD mobile-cellular low-user call distribution (2009 methodology):

	To fixed	On-net	Off-net	Total	Call distribution by time of day (%)
Call distribution (%)	17.0	56.0	26.0	100.0	100.0
Calls	5.2	16.9	7.9	30.0	
Peak	2.4	7.8	3.6	13.8	46.0
Off-peak	1.5	4.9	2.3	8.7	29.0
Weekend	1.3	4.2	2.0	7.5	25.0
Duration (minutes per call)	2.0	1.6	1.7		
Duration (total minutes of calls)	10.4	27.0	13.4	50.9	N/A
Peak	4.8	12.4	6.2	23.4	46.0
Off-peak	3.0	7.8	3.9	14.8	29.0
Weekend	2.6	6.8	3.4	12.7	25.0
Calls	30 calls per month				
sms	100 sms per month (50 on-net, 50 off-net)				

Note: N/A: Not applicable.
Source: ITU, based on OECD (2010b).

Box Annex 2.2: Rules applied in collecting mobile-cellular prices

1. The prices of the operator with the largest market share (measured by the number of subscriptions) are used. If prices vary between different regions of the country, prices refer to those applied in the largest city (in terms of population) or in the capital city.
2. Prices include taxes.[5]
3. Prices are reported and collected in national currency and then converted to USD and PPP$.
4. Prices refer to prepaid plans. Where the operator offers different packages with a certain number of calls and/or sms messages included, the one that comes closest to the 30 calls and 100 sms included is used. In countries where prepaid subscriptions account for less than 2 per cent of the total subscription base, postpaid prices may be used. In this case, the monthly subscription fee, plus any free minutes, will be taken into consideration for the calculation of the mobile-cellular sub-basket.
5. If per-minute prices are only advertised in internal units rather than in national currency, the price of the top-up/refill charge is used to convert internal units into national currency. If there are different refill prices, then the "cheapest/smallest" refill card is used. If different refill charges exist depending on the validity period, the validity period for 30 days (or closest to 30 days) is used.
6. Special offers and plans with limited availability (for example those reserved for a limited number of customers, or with a limited time period) are not taken into consideration.
7. If subscribers can chose "favourite" numbers (for family, friends, etc) with a special price, this special price will not be taken into consideration, irrespective of the quantity of numbers involved.
8. Prices refer to outgoing local calls. If different rates apply for local and national calls, then the local rate is used. If charges apply to incoming calls, these are not taken into consideration.
9. If prices vary between minutes (1st minute = price A, 2nd minute = price B, 3rd minute = price C), the sum of the different prices is divided by the number of different prices (for example: price per minute = (A+B+C)/3).
10. If prices vary beyond three minutes, the average price per minute is calculated based on the first three minutes.
11. If there is a connection cost per call, then this is taken into consideration in the formula for the mobile-cellular sub-basket, based on 30 calls.
12. If there are different off-peak prices, then the one that is the cheapest before midnight is used. If the only off-peak period is after midnight, then this is not used. Instead, the peak price is used.
13. If there are different peak prices, the most expensive one during the daytime is used.
14. If there are different weekend prices, the price that applies Sundays during the daytime is used (or the equivalent day in countries where weekends are not on Sundays).
15. If there is no weekend price, the average peak and off-peak price that is valid during the week is used.
16. If peak and off-peak sms prices exist, the average of both is used for on-net and off-net sms.
17. If calls are charged by call or by hour (and not by the minute), the mobile-cellular sub-basket formula will be calculated on the basis of 30 calls or 50.9 minutes. Similarly, if calls are charged by call or by number of minutes for a specific network/time of the day, this will be taken into account for that particular network/time of the day.
18. Where monthly, recurring charges exist, they are added to the sub-basket.

Box Annex 2.3: Rules applied in collecting fixed-broadband Internet prices

1. The prices of the operator with the largest market share (measured by the number of subscriptions) are used.
2. Prices include taxes.[6]
3. Prices are reported and collected in national currency and then converted to USD and PPP$.
4. Where operators propose different commitment periods, the 12-month plan (or the one closest to this commitment period) is used.
5. If prices vary between different regions of the country, prices refer to those applied in the largest city (in terms of population) or in the capital city.
6. The price for the most widely used fixed (wired)-broadband technology in the country (DSL, cable, etc.) is used.
7. The sub-basket does not include installation charges, modem prices or telephone-line rentals that are often required for a DSL service.
8. Prices refer to a regular (non-promotional) plan and exclude promotional offers or limited or restricted discounts.
9. With convergence, operators are increasingly providing multiple (bundled) services such as voice telephony, Internet access and television reception over their networks. They often bundle these offers into a single subscription. This can present a challenge for price data collection, since it may not be possible to isolate the prices for one service. It is preferable to use prices for a specific service; but if this is not possible, then the additional services that are included in the price will be specified in a note.

data per month. Preference should be given to the most widely used fixed (wired)-broadband technology (DSL, cable, etc.). The sub-basket does not include installation charges, modem prices or telephone-line rentals that are often required for a DSL service. The price represents the broadband entry plan in terms of the minimum speed of 256 kbit/s, but does not take into account special offers that are limited in time or to specific geographic areas. The plan does not necessarily represent the fastest or most cost-effective connection, since often the price for a higher-speed plan is cheaper in relative terms (i.e. in terms of the price per Mbit/s) (see Box Annex 2.3).

Endnotes

1 In some cases, it is not clear whether taxes are included or not and it was not possible to obtain this information from country contacts or operators; in such cases, the advertised price is used.

2 See endnote 1.

3 OECD (2010b).

4 On-net refers to a call made to the same mobile network, while off-net and fixed-line refer to calls made to other (competing) mobile networks and to a fixed-telephone line, respectively.

5 See endnote 1.

6 See endnote 1.

Annex 3. Statistical tables of indicators used to compute the IDI

Access indicators

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet access	
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
1	Albania	10.4	10.5	*84.0*	96.4	11’790	19’038	*15.6*	*16.4*	*13.7*	*15.7*
2	Algeria	8.2	8.5	92.4	99.0	8’120	8’933	*20.0*	*22.0*	*10.0*	*15.0*
3	Antigua & Barbuda	40.9	39.6	189.3	181.6	16’909	56’545	*50.9*	*54.0*	*40.0*	*45.0*
4	Argentina	*24.7*	*24.9*	*132.9*	*134.9*	*24’745*	*25’712*	47.0	*50.0*	*34.0*	*38.0*
5	Australia	47.6	46.6	101.0	108.3	*41’361*	*50’396*	*81.1*	82.6	*74.1*	78.9
6	Austria	40.5	40.3	145.8	154.8	*71’321*	*81’919*	76.2	*77.6*	72.9	75.4
7	Azerbaijan	16.4	18.1	99.0	108.7	9’692	19’102	21.5	*24.9*	35.3	*39.5*
8	Bahrain	18.1	20.9	124.2	128.0	*14’409*	14’719	87.0	90.0	74.0	76.8
9	Barbados	50.3	51.4	128.1	127.0	20’638	38’177	*61.4*	*65.3*	*51.0*	*54.6*
10	Belarus	43.1	44.0	107.7	111.9	21’958	52’833	40.8	46.4	31.2	40.3
11	Belgium	43.3	43.1	113.5	116.6	*112’023*	*131’137*	76.7	*81.9*	72.7	76.5
12	Benin	1.5	1.7	79.9	85.3	2’245	3’407	*2.5*	*2.8*	*1.2*	*1.8*
13	Bhutan	3.6	3.7	54.3	65.6	3’343	2’999	*7.2*	*9.1*	*6.0*	*8.1*
14	Bolivia	8.6	8.7	72.3	82.8	4’157	4’162	*23.3*	*27.0*	*7.5*	*9.4*
15	Bosnia and Herzegovina	26.6	25.5	82.7	84.5	15’650	*17’767*	*33.7*	*36.5*	*23.0*	*32.0*
16	Botswana	6.8	7.4	117.8	142.8	6’436	*8’442*	*6.5*	*7.2*	*4.3*	*6.4*
17	Brazil	21.6	21.9	104.1	123.2	*12’619*	29’041	34.9	45.4	27.1	37.8
18	Brunei Darussalam	20.0	19.7	109.1	109.2	*23’649*	*21’995*	*79.6*	*83.2*	*65.0*	*69.0*
19	Bulgaria	29.7	31.0	136.1	140.7	64’192	*65’832*	35.1	*38.0*	33.1	45.0
20	Burkina Faso	0.9	0.8	34.7	45.3	2’027	2’183	*2.1*	*2.8*	*2.0*	*2.4*
21	Cambodia	2.5	3.7	57.7	69.9	*28’067*	*13’530*	*4.3*	*4.9*	*1.6*	*2.8*
22	Cameroon	2.8	3.3	44.1	52.4	382	322	*5.4*	*6.2*	*1.9*	*3.0*
23	Canada	*50.0*	*47.9*	70.7	75.3	*54’914*	*70’150*	*83.9*	*86.0*	78.9	*82.8*
24	Cape Verde	14.5	14.9	75.0	79.2	3’125	5’806	*11.3*	*12.2*	*5.7*	*8.5*
25	Central African Rep.	0.1	0.1	22.2	25.0	*204*	*203*	*2.1*	*2.5*	*1.6*	*1.9*
26	Chad	0.5	0.3	25.6	31.8	101	228	*1.1*	*2.0*	*0.9*	*1.6*
27	Chile	20.2	19.5	116.0	129.7	19’140	*20’414*	*46.8*	*50.6*	*35.0*	*38.8*
28	China	21.9	21.2	64.0	73.2	2’389	2’692	*35.4*	*38.0*	*23.7*	*30.9*
29	Colombia	15.5	15.2	96.1	98.5	10’245	16’796	26.1	29.9	19.3	23.4
30	Comoros	2.9	3.1	22.5	28.7	4’430	4’003	*5.2*	*5.8*	*2.4*	*2.9*
31	Congo	0.2	0.2	94.0	93.8	*119*	155	*3.5*	3.9	*0.7*	1.0
32	Congo (Dem. Rep.)	0.1	0.1	17.9	23.1	232	984	*0.7*	*1.0*	*0.6*	*1.0*
33	Costa Rica	31.8	31.5	65.1	92.2	12’686	36’216	41.3	45.3	24.1	33.6
34	Côte d'Ivoire	1.4	1.3	79.0	86.4	9’650	18’044	*1.8*	*2.0*	*1.1*	*1.2*
35	Croatia	42.4	40.1	*111.9*	116.4	*20’745*	*19’948*	60.0	*64.0*	56.5	61.4
36	Cuba	10.3	10.6	8.9	11.7	220	175	*3.4*	*4.2*	*1.9*	*3.0*
37	Cyprus	37.4	36.3	93.7	97.7	51’640	53’569	60.5	*66.4*	53.7	57.4
38	Czech Republic	22.9	20.9	121.7	121.6	*69’240*	*91’064*	64.1	*69.0*	60.5	66.6
39	Denmark	47.1	45.1	125.8	126.5	*142’158*	*159’511*	88.0	*90.3*	86.1	90.1
40	Djibouti	2.1	2.0	18.6	21.3	14’489	*13’409*	*13.0*	*14.3*	*3.5*	*3.9*
41	Dominican Rep.	10.2	10.4	89.6	87.2	12’832	11’205	*16.4*	18.9	*10.2*	11.8
42	Ecuador	14.4	15.1	102.2	104.5	8’245	27’742	27.0	28.8	11.5	16.9
43	Egypt	11.9	10.6	87.1	101.1	5’836	6’754	34.0	36.4	31.2	*30.5*
44	El Salvador	16.2	*15.3*	124.3	*125.8*	2’900	*4’176*	13.3	*14.3*	8.0	*12.0*
45	Eritrea	1.0	1.1	3.5	4.5	106	89	*1.4*	*2.0*	*1.2*	*1.6*
46	Estonia	36.0	35.1	123.2	139.0	23’144	*24’378*	69.2	*75.3*	67.8	70.8
47	Ethiopia	1.1	1.0	8.3	16.7	5’357	6’486	*1.4*	*1.8*	*1.1*	*1.5*
48	Fiji	15.1	15.0	81.1	83.7	*3’631*	8’020	*26.8*	*29.3*	*18.8*	*22.1*
49	Finland	23.3	20.1	156.4	166.0	*107’267*	*118’445*	82.0	*86.6*	80.5	84.2
50	France	56.2	55.9	100.7	105.0	*69’593*	*78’590*	76.4	*81.2*	73.6	75.9
51	Gabon	2.0	*2.0*	106.9	*117.3*	52’083	46’187	*7.6*	*8.9*	*6.0*	*7.0*
52	Gambia	2.8	*2.8*	85.5	*89.0*	1’063	*1’709*	*5.7*	*6.4*	*3.8*	*5.2*
53	Georgia	25.4	31.0	91.4	102.3	*21’354*	*15’796*	18.2	*23.8*	16.6	*23.3*
54	Germany	64.2	63.0	127.0	132.3	*74’087*	74’786	85.7	*89.6*	82.5	83.3
55	Ghana	1.1	1.1	71.5	84.8	73	225	*9.1*	*10.2*	*2.6*	*4.0*
56	Greece	51.7	49.9	108.2	106.5	30’998	26’008	53.4	*56.9*	46.4	50.2
57	Guinea	0.2	*0.2*	40.1	*44.0*	1’503	1’731	*1.5*	*1.8*	*1.0*	*1.1*
58	Guyana	19.9	20.2	73.6	68.6	6’383	11’987	*7.2*	*9.0*	*6.1*	*8.0*
59	Honduras	8.8	7.9	125.1	104.0	*5’932*	4’866	*12.9*	*14.0*	*6.8*	*10.0*
60	Hong Kong, China	61.8	61.1	195.6	209.6	776’625	964’616	77.9	*80.8*	76.4	*79.6*
61	Hungary	29.8	29.4	120.3	117.3	*12’284*	*12’245*	66.4	*71.8*	60.5	65.2
62	Iceland	60.5	58.4	106.5	106.1	290’995	287’139	93.0	*94.5*	92.0	92.6
63	India	2.9	2.6	61.4	72.0	5’825	5’423	*6.1*	*6.9*	*4.2*	*6.0*
64	Indonesia	17.1	15.9	88.1	97.7	9’986	7’196	10.8	*12.0*	4.6	*7.0*
65	Iran (I.R.)	34.9	37.1	73.1	74.9	2’264	3’540	*33.7*	*35.0*	*20.8*	22.0
66	Ireland	46.5	45.2	105.2	108.4	*64’057*	*69’031*	76.5	*82.3*	71.7	78.1
67	Israel	45.9	46.3	*122.8*	121.7	*7’988*	*11’335*	76.7	79.0	68.1	71.0
68	Italy	35.5	34.6	149.6	151.8	61’531	*60’820*	64.8	*66.4*	59.0	61.6
69	Jamaica	9.6	9.9	116.1	108.1	19’777	*23’077*	22.7	*25.7*	14.0	*17.8*
70	Japan	51.9	51.1	97.4	102.7	15’831	23’111	83.4	*86.0*	81.3	*84.4*
71	Jordan	7.8	7.4	107.0	118.2	*7’725*	6’337	46.7	50.8	21.6	35.4
72	Kazakhstan	25.3	26.1	121.1	142.5	9’245	23’590	*46.0*	*50.0*	44.0	*48.0*
73	Kenya	0.9	0.7	61.6	64.8	3’563	4’544	*5.6*	*7.8*	*4.7*	*6.9*
74	Korea (Rep.)	59.2	60.9	105.4	108.5	11’878	17’170	81.8	81.9	96.8	97.2
75	Lao P.D.R.	1.7	1.7	64.6	87.2	2’304	2’048	*6.9*	*7.8*	*3.4*	*4.2*
76	Latvia	*23.6*	23.0	*102.4*	*102.9*	31’151	44’779	62.8	*64.5*	59.8	63.6
77	Lebanon	21.0	*21.1*	68.0	*78.6*	1’354	*2’257*	*61.5*	71.5	*50.7*	61.8
78	Liberia	0.1	0.1	39.3	49.2	599	573	*1.1*	*1.5*	*0.9*	*1.3*

	Economy	Fixed-telephone subscriptions per 100 inhabitants		Mobile-cellular subscriptions per 100 inhabitants		International Internet bandwidth Bit/s per Internet user		Percentage of households with computer		Percentage of households with Internet access	
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
79	Lithuania	22.1	21.9	147.2	151.3	45'426	57'571	59.2	*63.1*	60.6	61.8
80	Luxembourg	53.7	54.1	143.3	148.3	*86'985*	*89'564*	90.2	*92.0*	90.3	90.6
81	Macao' China	30.8	29.8	206.4	243.5	32'484	59'685	83.0	*85.0*	75.9	*78.0*
82	Madagascar	0.7	0.6	37.2	38.3	5'512	*5'679*	1.4	*2.2*	*1.3*	*2.0*
83	Malawi	1.0	1.1	20.9	25.1	2'049	1'421	*2.8*	*3.0*	*2.3*	*2.5*
84	Malaysia	16.1	14.7	119.2	127.0	11'445	10'651	61.8	64.1	55.6	61.4
85	Maldives	9.0	7.5	156.5	165.7	32'328	30'659	54.4	*62.9*	23.5	*28.9*
86	Mali	0.7	0.7	48.4	68.3	2'654	4'893	*3.0*	*3.4*	*1.2*	*1.4*
87	Malta	58.8	54.9	109.4	124.9	40'712	47'850	73.1	*75.5*	70.4	75.3
88	Mauritania	2.1	2.0	79.3	92.7	*2'023*	3'890	*3.0*	*3.4*	*1.6*	*2.5*
89	Mauritius	29.8	28.7	91.7	99.0	9'211	12'714	37.7	*38.2*	29.0	*36.4*
90	Mexico	17.5	17.1	80.6	82.4	7'316	8'743	29.8	*31.9*	22.2	*27.5*
91	Moldova	32.5	33.3	88.6	104.8	81'453	91'118	*36.9*	*41.6*	*34.7*	*41.0*
92	Mongolia	7.0	6.7	91.1	105.1	48'348	53'576	22.3	*25.2*	7.7	*9.0*
93	Morocco	11.7	11.0	100.1	113.3	4'790	7'558	34.0	39.0	25.0	35.0
94	Mozambique	0.4	0.4	30.9	32.8	1'312	1'244	*4.9*	*5.3*	*2.4*	*3.5*
95	Myanmar	1.0	1.1	*1.2*	2.6	*8'340*	8'180	*1.3*	*1.8*	*1.0*	*1.4*
96	Namibia	6.9	6.0	67.2	105.0	*2'473*	2'349	11.5	*13.0*	*7.0*	*10.0*
97	Nepal	2.8	2.8	30.7	43.8	*1'684*	1'531	*4.2*	*4.6*	*2.1*	*3.1*
98	Netherlands	43.5	42.8	115.4	119.0	*154'333*	*162'532*	92.0	*93.0*	90.9	93.6
99	New Zealand	43.0	42.6	107.8	109.2	*19'307*	*23'706*	*83.9*	*87.4*	*79.0*	*83.3*
100	Nicaragua	4.5	4.9	68.5	82.2	*8'638*	12'857	*8.2*	*9.0*	*3.8*	*5.6*
101	Niger	0.5	*0.6*	24.5	27.0	*1'476*	*1'005*	*1.2*	1.5	*0.6*	*1.0*
102	Nigeria	0.7	0.4	55.1	58.6	*132*	*368*	*8.0*	*9.3*	*4.0*	*4.6*
103	Norway	*45.4*	*42.7*	115.7	*116.8*	*109'641*	*151'257*	90.9	*93.6*	89.8	*92.2*
104	Oman	10.1	10.1	165.5	169.0	6'108	11'648	54.3	*58.0*	35.5	*38.9*
105	Pakistan	3.5	3.2	57.1	61.6	5'443	4'752	*9.7*	*11.0*	*5.7*	*6.7*
106	Panama	15.3	15.2	189.0	203.9	46'432	44'121	27.9	*29.0*	20.3	20.7
107	Papua New Guinea	1.8	*1.9*	27.8	*34.2*	3'167	*5'703*	*2.8*	*3.0*	2.2	*2.5*
108	Paraguay	5.6	5.6	91.7	99.4	8'302	9'482	19.3	*22.7*	13.8	*19.3*
109	Peru	10.9	11.1	100.1	110.4	8'372	*9'319*	23.0	*25.4*	*14.0*	*17.7*
110	Philippines	7.3	7.2	85.7	92.0	*10'723*	*12'360*	*13.1*	*15.1*	*10.1*	*15.0*
111	Poland	20.0	*18.1*	122.7	*128.5*	*37'729*	*40'244*	69.0	*73.0*	63.4	66.6
112	Portugal	41.9	42.3	114.4	114.9	*146'649*	*135'332*	*59.5*	*63.1*	53.7	58.0
113	Qatar	16.6	16.4	124.3	123.1	17'072	22'333	87.0	88.3	81.8	83.6
114	Romania	20.9	21.9	113.6	109.2	67'603	114'451	47.9	*52.9*	42.2	47.4
115	Russian Federation	31.4	30.9	166.3	179.3	30'776	31'911	55.0	*57.1*	41.3	*46.0*
116	Rwanda	0.4	0.4	33.4	40.6	1'933	4'414	1.3	*2.0*	*3.2*	*5.0*
117	Saudi Arabia	15.2	16.5	187.9	191.2	28'252	32'985	*57.3*	62.8	*54.4*	*60.5*
118	Senegal	2.7	2.7	67.1	73.3	2'413	2'909	*5.7*	*6.1*	*4.5*	*5.0*
119	Serbia	38.3	37.3	122.1	125.4	*44'425*	76'761	*50.9*	*55.8*	*40.2*	*43.9*
120	Seychelles	25.5	32.1	135.9	145.7	5'229	5'867	37.8	*45.0*	26.1	*34.0*
121	Singapore	39.2	38.9	145.2	149.5	182'535	547'064	84.0	86.0	82.0	85.0
122	Slovakia	20.1	19.3	108.5	109.3	12'091	12'276	72.2	*79.4*	67.5	70.8
123	Slovenia	44.9	42.9	104.5	106.6	*70'384*	*68'250*	70.5	*75.1*	68.1	72.6
124	Solomon Islands	*1.5*	1.5	*27.9*	49.8	*3'716*	3'893	*3.8*	*4.4*	*2.9*	*3.5*
125	South Africa	8.4	*8.2*	100.5	*126.8*	*14'406*	*18'874*	*18.3*	*19.5*	10.1	9.8
126	Spain	43.9	42.3	112.0	114.2	*56'071*	*64'069*	68.7	*72.6*	59.1	63.9
127	Sri Lanka	17.2	17.1	83.2	87.0	3'316	5'224	*12.3*	*13.6*	*5.9*	*8.1*
128	Saint Lucia	21.5	20.4	113.7	123.0	*57'383*	*81'149*	*49.0*	*52.0*	*41.0*	*44.0*
129	St. Vincent and the Grenadines	19.9	20.8	120.5	120.5	712'704	637'784	*55.1*	*58.0*	*40.3*	*45.0*
130	Swaziland	4.5	4.4	61.2	63.7	1'222	2'347	*10.7*	*11.2*	*7.0*	*9.5*
131	Sweden	52.5	48.7	116.1	118.6	*236'919*	*244'440*	89.5	*91.5*	88.3	90.6
132	Switzerland	64.0	60.8	125.8	130.1	*155'512*	*167'636*	*86.9*	*90.0*	85.0	*88.9*
133	Syria	19.9	20.9	57.8	63.2	1'357	3'489	*40.4*	*40.5*	*35.2*	*36.0*
134	Tanzania	0.4	0.3	46.8	55.5	701	*902*	*3.6*	4.0	*3.1*	4.5
135	TFYR Macedonia	20.0	20.0	104.5	109.4	*16'831*	*17'945*	*60.3*	64.8	*49.2*	51.6
136	Thailand	10.0	9.7	103.6	113.2	10'248	*10'622*	22.8	24.7	11.4	13.4
137	Togo	3.5	*3.9*	40.7	50.4	7'676	6'443	*3.7*	*3.8*	*1.8*	*3.0*
138	Tonga	*29.8*	28.7	52.2	52.6	*3'003*	3'827	*10.1*	*13.7*	*7.8*	*10.6*
139	Trinidad & Tobago	21.9	21.7	141.2	135.6	20'522	19'753	*53.1*	*56.3*	*29.0*	*35.0*
140	Tunisia	12.3	11.5	106.0	116.9	13'275	14'832	19.1	*21.0*	11.4	*16.0*
141	Turkey	22.3	20.7	84.9	88.7	19'087	33'938	44.2	48.5	41.6	42.9
142	Turkmenistan	10.3	*10.7*	63.4	*68.8*	2'578	*1'567*	*10.0*	*12.2*	*5.6*	*6.0*
143	Tuvalu	12.2	14.7	16.3	21.6	1'628	1'354	*18.3*	*23.4*	*14.0*	*18.0*
144	Uganda	1.0	1.3	38.4	48.4	864	*1'752*	*3.1*	*4.0*	*3.2*	*4.5*
145	Ukraine	28.5	28.1	118.6	123.0	*11'332*	*9'835*	25.2	*30.7*	22.2	*26.0*
146	United Arab Emirates	19.7	23.1	145.5	148.6	20'576	27'609	76.0	77.0	65.0	67.0
147	United Kingdom	53.9	53.2	130.8	130.8	*144'665*	*166'073*	82.6	*84.0*	79.6	85.1
148	United States	48.7	*47.9*	89.9	105.9	*39'184*	*47'174*	*75.5*	*77.2*	*71.6*	*76.0*
149	Uruguay	28.6	28.5	131.7	140.8	24'138	32'078	52.8	*62.0*	33.3	*39.4*
150	Uzbekistan	*6.9*	6.9	*76.3*	91.6	466	579	*5.2*	*6.3*	*5.9*	*7.8*
151	Venezuela	24.4	24.9	96.2	97.8	*6'464*	*8'108*	*17.3*	*19.0*	*11.0*	*16.0*
152	Viet Nam	16.4	11.5	127.0	143.4	4'992	*9'998*	*14.2*	16.0	12.5	*14.0*
153	Yemen	4.3	4.3	46.1	47.0	1'077	*1'082*	*4.0*	*4.6*	*2.9*	*4.0*
154	Zambia	0.9	0.6	41.6	60.6	*382*	*452*	*2.4*	*2.7*	*2.0*	*2.4*
155	Zimbabwe	3.0	2.8	61.2	72.1	300	1'748	*5.3*	*5.9*	*4.0*	*4.0*

Source: ITU World Telecommunication/ICT Indicators database.
Note: Data in italics refer to ITU estimates.

Use indicators

	Economy	Percentage of individuals using the Internet		Fixed (wired)-broadband subscriptions per 100 inhabitants		Active mobile-broadband subscriptions per 100 inhabitants	
		2010	2011	2010	2011	2010	2011
1	Albania	45.0	*49.0*	3.3	4.3	*0.0*	8.8
2	Algeria	12.5	*14.0*	2.5	*2.8*	*0.0*	*0.0*
3	Antigua & Barbuda	80.0	82.0	8.0	6.7	*0.0*	19.7
4	Argentina	40.0	*47.7*	9.6	*10.5*	5.0	*11.7*
5	Australia	*76.0*	79.0	23.2	23.9	30.5	42.8
6	Austria	75.2	79.8	24.7	26.5	29.3	43.3
7	Azerbaijan	46.0	*50.0*	5.0	10.7	5.0	21.5
8	Bahrain	55.0	77.0	5.4	13.8	3.6	9.5
9	Barbados	*70.2*	*71.8*	20.6	22.1	0.0	0.0
10	Belarus	31.8	39.6	17.4	21.9	*12.5*	18.9
11	Belgium	75.0	*78.0*	31.5	33.0	9.7	19.4
12	Benin	3.1	3.5	0.0	0.0	*0.0*	*0.0*
13	Bhutan	13.6	21.0	1.2	1.8	0.3	1.0
14	Bolivia	*22.4*	*30.0*	1.0	0.7	1.1	1.9
15	Bosnia and Herzegovina	52.0	*60.0*	8.2	11.5	5.4	9.2
16	Botswana	6.0	7.0	0.6	0.8	*1.5*	*1.5*
17	Brazil	40.7	45.0	6.8	8.6	10.6	20.9
18	Brunei Darussalam	*53.0*	*56.0*	5.4	5.5	5.5	6.3
19	Bulgaria	46.2	51.0	14.5	15.5	8.0	14.5
20	Burkina Faso	*2.4*	*3.0*	0.1	0.1	*0.0*	*0.0*
21	Cambodia	1.3	*3.1*	0.3	0.2	*0.7*	2.2
22	Cameroon	*4.3*	*5.0*	*0.0*	*0.0*	*0.0*	*0.0*
23	Canada	80.3	*83.0*	29.8	*32.0*	*30.5*	*32.9*
24	Cape Verde	*30.0*	*32.0*	3.2	4.3	*0.0*	3.0
25	Central African Rep.	*2.0*	*2.2*	0.0	0.0	0.0	*0.0*
26	Chad	*1.7*	*1.9*	0.0	0.0	*0.0*	*0.0*
27	Chile	*45.0*	*53.9*	10.5	11.6	8.4	17.1
28	China	34.3	38.3	9.4	11.6	*3.5*	*9.5*
29	Colombia	36.5	40.4	5.6	6.9	2.4	3.7
30	Comoros	*5.1*	*5.5*	*0.0*	*0.0*	*0.0*	*0.0*
31	Congo	*5.0*	5.6	0.0	0.0	*0.0*	*1.2*
32	Congo (Dem. Rep.)	0.7	*1.2*	0.0	0.0	*0.0*	*0.0*
33	Costa Rica	36.5	42.1	6.2	8.7	*1.4*	*2.0*
34	Côte d'Ivoire	*2.1*	*2.2*	*0.0*	0.1	0.0	0.0
35	Croatia	60.3	70.7	18.3	19.5	7.5	6.6
36	Cuba	15.9	23.2	0.0	0.0	*0.0*	*0.0*
37	Cyprus	53.0	57.7	17.6	18.1	29.5	24.1
38	Czech Republic	68.8	73.0	14.5	15.7	34.1	43.1
39	Denmark	88.7	90.0	37.7	38.2	63.9	80.2
40	Djibouti	*6.5*	*7.0*	0.9	1.2	*0.0*	*0.0*
41	Dominican Rep.	*31.4*	35.5	3.6	4.0	2.5	7.7
42	Ecuador	29.0	31.4	1.4	4.2	9.1	10.3
43	Egypt	30.2	35.6	1.8	2.2	16.4	21.0
44	El Salvador	15.9	*17.7*	2.8	*3.3*	*2.3*	*3.6*
45	Eritrea	5.4	*6.2*	0.0	0.0	*0.0*	*0.0*
46	Estonia	74.1	76.5	25.1	27.1	24.0	42.0
47	Ethiopia	*0.8*	*1.1*	0.0	0.0	*0.1*	*0.3*
48	Fiji	*20.0*	*28.0*	2.7	2.7	*0.0*	15.5
49	Finland	86.9	89.4	29.3	29.5	84.3	87.1
50	France	80.1	79.6	33.9	36.1	36.6	44.0
51	Gabon	7.2	*8.0*	0.3	*0.3*	*0.0*	*0.0*
52	Gambia	9.2	*10.9*	0.0	*0.0*	*0.5*	*0.5*
53	Georgia	26.9	*36.6*	5.8	7.6	14.8	20.5
54	Germany	82.0	83.0	31.7	32.5	25.8	34.8
55	Ghana	12.7	*14.1*	0.2	0.3	6.9	23.0
56	Greece	44.4	53.0	19.9	21.6	24.5	31.8
57	Guinea	*1.0*	*1.3*	0.0	*0.0*	*0.0*	*0.0*
58	Guyana	29.9	*32.0*	1.5	2.5	*0.0*	*0.0*
59	Honduras	11.1	15.9	*0.0*	0.0	*1.3*	3.7
60	Hong Kong, China	72.0	*74.5*	29.9	31.5	38.9	51.8
61	Hungary	53.0	59.0	20.6	22.2	7.8	13.2
62	Iceland	95.0	95.0	33.4	33.9	45.3	60.7
63	India	*7.5*	10.1	0.9	1.0	*0.0*	*1.9*
64	Indonesia	10.9	*18.0*	1.0	1.1	18.7	22.2
65	Iran (I.R.)	*16.0*	*21.0*	*1.3*	2.4	*0.0*	*0.0*
66	Ireland	69.9	76.8	21.1	22.1	67.6	59.4
67	Israel	67.5	70.0	*23.8*	23.8	*32.4*	*41.0*
68	Italy	53.7	56.8	21.6	*22.8*	27.6	31.3
69	Jamaica	27.7	*31.5*	4.3	3.9	1.5	*1.5*
70	Japan	78.2	*79.5*	26.9	27.4	*88.2*	*93.7*
71	Jordan	27.2	34.9	3.2	3.2	0.0	4.9
72	Kazakhstan	31.6	*45.0*	8.9	7.5	*23.1*	38.4
73	Kenya	14.0	*28.0*	0.0	0.1	0.2	0.3
74	Korea (Rep.)	83.7	83.8	35.7	36.9	98.2	105.1
75	Lao P.D.R.	7.0	9.0	0.2	0.7	*0.4*	*0.6*
76	Latvia	68.4	71.7	19.3	20.4	*27.5*	37.6
77	Lebanon	*43.7*	52.0	*4.7*	*5.2*	*0.0*	*0.0*
78	Liberia	2.3	*3.0*	0.0	0.0	*0.0*	0.2

	Economy	Percentage of individuals using the Internet		Fixed (wired)-broadband subscriptions per 100 inhabitants		Active mobile-broadband subscriptions per 100 inhabitants	
		2010	2011	2010	2011	2010	2011
79	Lithuania	62.1	65.1	20.6	22.1	14.2	*17.2*
80	Luxembourg	90.6	90.9	33.2	32.9	61.4	66.7
81	Macao, China	53.8	*58.0*	24.2	24.7	152.7	216.1
82	Madagascar	*1.7*	1.9	*0.0*	*0.0*	0.0	*0.1*
83	Malawi	2.3	3.3	0.1	0.1	0.6	3.1
84	Malaysia	56.3	61.0	6.5	7.4	10.1	12.3
85	Maldives	28.3	*34.0*	4.8	6.4	6.6	17.4
86	Mali	*1.9*	*2.0*	0.0	0.0	*0.4*	0.4
87	Malta	63.0	69.2	28.1	30.0	19.7	32.6
88	Mauritania	*4.0*	4.5	0.2	0.2	0.5	*0.5*
89	Mauritius	28.3	*35.0*	6.1	8.9	13.7	12.4
90	Mexico	31.1	36.2	10.0	10.6	1.9	4.6
91	Moldova	32.3	38.0	7.5	9.9	*3.4*	3.5
92	Mongolia	12.9	*20.0*	2.6	2.8	7.3	12.7
93	Morocco	49.0	51.0	1.6	1.8	4.9	8.0
94	Mozambique	4.2	*4.3*	0.1	0.1	*0.6*	*1.0*
95	Myanmar	0.3	1.0	0.0	0.1	*0.0*	0.0
96	Namibia	11.6	*12.0*	0.4	0.8	*0.4*	3.6
97	Nepal	7.9	9.0	*0.2*	0.3	*0.0*	*0.0*
98	Netherlands	90.7	92.3	38.1	38.7	38.0	49.2
99	New Zealand	83.0	86.0	24.9	25.8	39.5	53.0
100	Nicaragua	*10.0*	10.6	1.6	1.8	0.8	1.0
101	Niger	*0.8*	1.3	*0.0*	0.0	*0.0*	*0.0*
102	Nigeria	*24.0*	28.4	*0.1*	0.1	*0.6*	*2.8*
103	Norway	93.4	94.0	35.3	*36.5*	19.4	*24.4*
104	Oman	62.0	*68.0*	1.6	1.8	26.4	37.8
105	Pakistan	*8.0*	*9.0*	0.3	0.4	0.2	0.3
106	Panama	40.1	42.7	7.3	7.9	*3.4*	14.5
107	Papua New Guinea	1.3	*2.0*	0.1	*0.1*	*0.0*	*0.0*
108	Paraguay	19.8	*23.9*	0.4	1.0	2.7	4.5
109	Peru	34.8	36.5	3.1	*3.5*	0.9	1.4
110	Philippines	25.0	*29.0*	*1.8*	*1.9*	*2.3*	*3.4*
111	Poland	62.3	64.9	13.0	*14.4*	50.0	48.4
112	Portugal	51.1	55.3	19.9	21.0	24.0	27.4
113	Qatar	81.6	86.2	8.1	8.7	46.5	61.0
114	Romania	39.9	44.0	14.0	15.4	10.7	14.1
115	Russian Federation	43.0	49.0	11.0	12.2	34.7	47.9
116	Rwanda	8.0	*7.0*	0.0	0.0	*1.3*	*6.4*
117	Saudi Arabia	*41.0*	47.5	5.5	5.7	9.8	40.4
118	Senegal	16.0	17.5	0.6	0.7	0.2	1.5
119	Serbia	40.9	42.2	10.6	10.8	17.5	34.5
120	Seychelles	41.0	*43.2*	7.3	8.9	1.6	4.7
121	Singapore	71.0	*75.0*	25.0	25.5	98.2	110.9
122	Slovakia	75.7	74.4	12.7	13.6	20.7	31.9
123	Slovenia	70.0	72.0	23.7	24.8	24.4	29.3
124	Solomon Islands	*5.0*	*6.0*	*0.4*	0.4	*0.0*	3.8
125	South Africa	*18.0*	*21.0*	1.5	*1.8*	*17.4*	*19.8*
126	Spain	65.8	67.6	22.9	23.5	25.7	40.9
127	Sri Lanka	12.0	*15.0*	1.1	1.7	1.4	2.3
128	Saint Lucia	*40.0*	*42.0*	11.8	12.1	0.0	0.0
129	St. Vincent and the Grenadines	*38.5*	43.0	11.4	12.9	*0.0*	0.0
130	Swaziland	11.0	18.1	0.1	0.2	0.3	0.7
131	Sweden	90.0	91.0	31.8	31.8	82.9	91.5
132	Switzerland	83.9	85.2	38.0	39.2	30.7	36.1
133	Syria	20.7	22.5	0.3	0.6	0.5	1.0
134	Tanzania	11.0	*12.0*	0.0	*0.0*	1.0	*1.2*
135	TFYR Macedonia	51.9	56.7	12.5	13.2	18.8	18.7
136	Thailand	22.4	23.7	4.6	5.4	*0.0*	*0.0*
137	Togo	*3.0*	*3.5*	0.1	*0.1*	0.0	0.4
138	Tonga	*16.0*	25.0	*1.1*	1.2	*0.0*	0.1
139	Trinidad & Tobago	48.5	55.2	10.8	11.5	0.5	1.2
140	Tunisia	36.8	39.1	4.6	5.1	0.9	2.4
141	Turkey	39.8	42.1	9.7	10.3	2.0	8.8
142	Turkmenistan	*3.0*	*5.0*	0.0	*0.0*	*0.0*	*0.0*
143	Tuvalu	*25.0*	*30.0*	2.4	4.6	*0.0*	*0.0*
144	Uganda	12.5	*13.0*	0.2	0.3	1.6	2.8
145	Ukraine	23.3	30.6	6.5	7.0	*4.2*	*4.4*
146	United Arab Emirates	68.0	70.0	10.5	11.0	15.0	21.7
147	United Kingdom	78.0	82.0	30.8	32.7	*43.2*	62.3
148	United States	74.0	*77.9*	27.6	*28.7*	52.7	*65.5*
149	Uruguay	46.4	51.4	10.9	13.5	*5.6*	*9.0*
150	Uzbekistan	*20.0*	30.2	*0.4*	0.5	15.0	18.4
151	Venezuela	37.4	40.2	0.8	0.9	3.1	4.2
152	Viet Nam	30.7	35.1	4.2	4.3	*8.0*	18.0
153	Yemen	12.4	*14.9*	0.3	0.4	*0.0*	0.1
154	Zambia	10.0	11.5	0.1	*0.1*	0.3	0.4
155	Zimbabwe	11.5	15.7	0.3	0.3	4.8	14.9

Source: ITU World Telecommunication/ICT Indicators database.
Note: Data in italics refer to ITU estimates.

Skills indicators

		Gross enrolment ratio				Adult literacy rate	
		Secondary		Tertiary			
	Economy	2010	2011	2010	2011	2010	2011
1	Albania	88.9	88.9	*36.7*	*36.7*	95.9	95.9
2	Algeria	94.9	94.9	30.8	30.8	72.6	72.6
3	Antigua & Barbuda	105.4	105.4	16.4	16.4	99.0	99.0
4	Argentina	88.5	88.5	71.2	71.2	97.7	97.7
5	Australia	129.2	129.2	75.9	75.9	*99.0*	*99.0*
6	Austria	99.6	99.6	60.2	60.2	*99.0*	*99.0*
7	Azerbaijan	84.6	84.6	19.3	19.3	99.5	99.5
8	Bahrain	103.1	103.1	*51.2*	*51.2*	91.4	91.4
9	Barbados	100.6	100.6	65.9	65.9	*99.0*	*99.0*
10	Belarus	95.9	95.9	83.0	83.0	99.7	99.7
11	Belgium	110.5	110.5	67.5	67.5	*99.0*	*99.0*
12	Benin	37.1	37.1	6.0	6.0	41.7	41.7
13	Bhutan	*61.7*	*61.7*	7.0	8.8	52.8	52.8
14	Bolivia	80.2	80.2	38.6	38.6	90.7	90.7
15	Bosnia and Herzegovina	89.6	89.6	35.9	35.9	97.8	97.8
16	Botswana	80.0	80.0	7.4	7.4	84.1	84.1
17	Brazil	101.3	101.3	36.1	36.1	90.0	90.0
18	Brunei Darussalam	109.7	109.7	17.2	17.2	95.3	95.3
19	Bulgaria	88.0	88.0	53.0	53.0	98.3	98.3
20	Burkina Faso	20.7	22.6	3.3	3.3	28.7	28.7
21	Cambodia	46.2	46.2	7.8	7.8	77.6	77.6
22	Cameroon	42.2	42.2	11.5	11.5	70.7	70.7
23	Canada	101.3	101.3	*66.6*	*66.6*	*99.0*	*99.0*
24	Cape Verde	87.5	87.5	17.8	17.8	84.8	84.8
25	Central African Rep.	12.6	12.6	2.6	2.6	55.2	55.2
26	Chad	25.7	25.7	2.2	2.2	33.6	33.6
27	Chile	87.9	87.9	59.2	59.2	98.6	98.6
28	China	81.2	81.2	25.9	25.9	94.0	94.0
29	Colombia	96.4	96.4	39.1	39.1	93.2	93.2
30	Comoros	46.3	46.3	7.9	7.9	74.2	74.2
31	Congo	37.7	37.7	5.5	5.5	66.8	66.8
32	Congo (Dem. Rep.)	37.7	37.7	6.2	6.2	66.8	66.8
33	Costa Rica	99.7	99.7	25.6	25.6	96.1	96.1
34	Côte d'Ivoire	*29.9*	*29.9*	8.9	8.9	55.3	55.3
35	Croatia	95.3	95.3	49.2	49.2	98.8	98.8
36	Cuba	89.4	89.4	95.2	95.2	99.8	99.8
37	Cyprus	98.4	98.4	52.0	52.0	97.9	97.9
38	Czech Republic	90.4	90.4	60.7	60.7	*99.0*	*99.0*
39	Denmark	117.4	117.4	74.4	74.4	*99.0*	*99.0*
40	Djibouti	30.2	36.1	3.4	4.9	*73.0*	*73.0*
41	Dominican Rep.	76.4	76.4	*34.2*	*34.2*	88.2	88.2
42	Ecuador	80.4	80.4	39.8	39.8	84.2	84.2
43	Egypt	*80.5*	*80.5*	30.4	30.4	66.4	66.4
44	El Salvador	65.0	65.0	23.4	23.4	84.1	84.1
45	Eritrea	31.9	31.9	2.0	2.0	66.6	66.6
46	Estonia	103.6	103.6	62.7	62.7	99.8	99.8
47	Ethiopia	35.7	35.7	5.5	5.5	29.8	29.8
48	Fiji	86.5	86.5	16.1	16.1	*95.1*	*95.1*
49	Finland	107.5	107.5	91.6	91.6	*99.0*	*99.0*
50	France	112.6	112.6	54.5	54.5	*99.0*	*99.0*
51	Gabon	*58.4*	*58.4*	*6.6*	*6.6*	87.7	87.7
52	Gambia	54.1	54.1	4.1	4.1	46.5	46.5
53	Georgia	86.2	86.2	28.2	28.2	99.7	99.7
54	Germany	102.6	102.6	*46.2*	*46.2*	*99.0*	*99.0*
55	Ghana	59.1	58.1	8.8	8.8	66.6	66.6
56	Greece	100.9	100.9	89.4	89.4	97.2	97.2
57	Guinea	38.1	38.1	9.5	9.5	39.5	39.5
58	Guyana	91.0	91.0	11.9	11.9	*99.0*	*99.0*
59	Honduras	73.5	73.5	18.8	18.8	83.6	83.6
60	Hong Kong, China	83.0	83.0	59.7	59.7	*99.0*	*99.0*
61	Hungary	98.3	98.3	61.7	61.7	99.4	99.4
62	Iceland	107.2	107.2	74.1	74.1	*99.0*	*99.0*
63	India	60.2	60.2	16.2	16.2	62.8	62.8
64	Indonesia	77.2	77.2	23.1	23.1	92.2	92.2
65	Iran (I.R.)	83.5	83.5	42.8	42.8	85.0	85.0
66	Ireland	117.3	117.3	61.0	61.0	*99.0*	*99.0*
67	Israel	91.0	91.0	62.5	62.5	*99.0*	*99.0*
68	Italy	99.1	99.1	66.0	66.0	98.9	98.9
69	Jamaica	92.7	92.7	29.0	29.0	86.4	86.4
70	Japan	101.5	101.5	59.0	59.0	*99.0*	*99.0*
71	Jordan	91.1	91.1	41.8	41.8	92.2	92.2
72	Kazakhstan	97.0	99.6	38.5	40.8	99.7	99.7
73	Kenya	60.2	60.2	4.0	4.0	87.0	87.0
74	Korea (Rep.)	97.1	97.1	103.9	103.9	*99.0*	*99.0*
75	Lao P.D.R.	44.7	44.7	13.4	13.4	72.7	72.7
76	Latvia	95.2	95.2	60.1	60.1	99.8	99.8
77	Lebanon	81.4	81.4	54.0	54.0	89.6	89.6
78	Liberia	24.4	24.4	4.4	4.4	59.1	59.1

		Gross enrolment ratio				Adult literacy rate	
		Secondary		Tertiary			
	Economy	2010	2011	2010	2011	2010	2011
79	Lithuania	98.0	98.0	77.4	77.4	99.7	99.7
80	Luxembourg	97.6	97.6	10.5	10.5	*99.0*	*99.0*
81	Macao, China	92.4	92.4	64.9	64.9	93.5	93.5
82	Madagascar	31.1	31.1	3.7	3.7	64.5	64.5
83	Malawi	32.1	32.1	0.7	0.7	73.7	73.7
84	Malaysia	68.3	68.3	40.2	40.2	92.5	92.5
85	Maldives	*91.8*	*91.8*	*0.0*	*0.0*	98.4	98.4
86	Mali	37.7	39.4	5.8	5.8	26.2	26.2
87	Malta	104.8	104.8	33.4	33.4	92.4	92.4
88	Mauritania	24.4	24.4	4.4	4.4	57.5	57.5
89	Mauritius	89.4	89.4	24.9	24.9	87.9	87.9
90	Mexico	86.9	86.9	27.0	27.0	93.4	93.4
91	Moldova	88.0	88.0	38.1	38.1	98.5	98.5
92	Mongolia	92.9	92.9	53.3	53.3	97.5	97.5
93	Morocco	56.1	56.1	13.2	13.2	56.1	56.1
94	Mozambique	25.5	25.5	1.5	1.5	55.1	55.1
95	Myanmar	54.3	54.3	11.0	11.0	92.0	92.0
96	Namibia	64.0	64.0	9.0	9.0	88.5	88.5
97	Nepal	43.5	43.5	*10.1*	*10.1*	59.1	59.1
98	Netherlands	120.2	120.2	62.7	62.7	*99.0*	*99.0*
99	New Zealand	119.1	119.1	82.6	82.6	*99.0*	*99.0*
100	Nicaragua	69.4	69.4	*19.5*	*19.5*	78.0	78.0
101	Niger	13.4	13.4	1.5	1.5	28.7	28.7
102	Nigeria	44.0	44.0	10.3	10.3	60.8	60.8
103	Norway	110.2	110.2	73.8	73.8	*99.0*	*99.0*
104	Oman	100.3	100.3	24.5	24.5	86.6	86.6
105	Pakistan	34.2	34.2	5.4	5.4	55.5	55.5
106	Panama	74.1	74.1	44.6	44.6	93.6	93.6
107	Papua New Guinea	22.7	*22.7*	*15.4*	*15.4*	60.1	60.1
108	Paraguay	66.9	66.9	36.6	36.6	94.6	94.6
109	Peru	91.6	91.6	35.0	35.0	89.6	89.6
110	Philippines	84.8	84.8	28.9	28.9	95.4	95.4
111	Poland	97.0	97.0	70.5	70.5	99.5	99.5
112	Portugal	106.7	106.7	62.2	62.2	94.9	94.9
113	Qatar	93.7	93.7	10.0	10.0	94.7	94.7
114	Romania	95.1	95.1	63.8	63.8	97.7	97.7
115	Russian Federation	88.6	88.6	75.9	75.9	99.6	99.6
116	Rwanda	32.2	32.2	5.5	5.5	70.7	70.7
117	Saudi Arabia	100.6	100.6	36.8	36.8	86.1	86.1
118	Senegal	37.4	37.4	7.9	7.9	49.7	49.7
119	Serbia	91.4	91.4	49.1	49.1	97.8	97.8
120	Seychelles	119.2	119.2	*1.8*	*1.8*	91.8	91.8
121	Singapore	*74.1*	*74.1*	*43.8*	*43.8*	94.7	94.7
122	Slovakia	89.4	89.4	54.2	54.2	*99.0*	*99.0*
123	Slovenia	97.1	97.1	86.9	86.9	99.7	99.7
124	Solomon Islands	35.5	35.5	16.1	16.1	82.0	82.0
125	South Africa	93.8	93.8	*15.8*	*15.8*	88.7	88.7
126	Spain	119.0	119.0	73.2	73.2	97.7	97.7
127	Sri Lanka	*87.8*	*87.8*	15.5	15.5	90.6	90.6
128	Saint Lucia	96.1	96.1	11.3	11.3	99.0	99.0
129	St. Vincent and the Grenadines	107.5	107.5	18.2	18.2	99.0	99.0
130	Swaziland	58.1	58.1	4.4	4.4	86.9	86.9
131	Sweden	100.3	100.3	70.8	70.8	*99.0*	*99.0*
132	Switzerland	95.2	95.2	51.5	51.5	*99.0*	*99.0*
133	Syria	72.4	72.4	*15.7*	*15.7*	84.2	84.2
134	Tanzania	*27.4*	*27.4*	2.1	2.1	72.9	72.9
135	TFYR Macedonia	82.8	82.8	40.4	40.4	97.1	97.1
136	Thailand	77.2	79.2	46.2	47.7	93.5	93.5
137	Togo	45.5	45.5	5.9	5.9	56.9	56.9
138	Tonga	101.3	101.3	16.1	16.1	99.0	99.0
139	Trinidad & Tobago	89.9	89.9	11.5	11.5	98.7	98.7
140	Tunisia	90.5	90.5	34.4	34.4	77.6	77.6
141	Turkey	77.6	77.6	45.8	45.8	90.8	90.8
142	Turkmenistan	*85.0*	*85.0*	*21.7*	*21.7*	99.6	99.6
143	Tuvalu	35.5	35.5	16.1	16.1	82.0	82.0
144	Uganda	28.1	28.1	4.2	4.2	71.4	71.4
145	Ukraine	95.6	95.6	79.5	79.5	99.7	99.7
146	United Arab Emirates	92.3	92.3	*30.4*	*30.4*	90.0	90.0
147	United Kingdom	101.8	101.8	58.5	58.5	*99.0*	*99.0*
148	United States	96.0	96.0	94.8	94.8	*99.0*	*99.0*
149	Uruguay	90.2	90.2	63.3	63.3	98.3	98.3
150	Uzbekistan	104.8	105.7	9.9	8.9	99.3	99.3
151	Venezuela	82.5	82.5	78.1	78.1	95.2	95.2
152	Viet Nam	77.2	77.2	22.3	22.3	92.8	92.8
153	Yemen	44.1	44.1	10.2	10.2	62.4	62.4
154	Zambia	*45.5*	*45.5*	*2.4*	*2.4*	70.9	70.9
155	Zimbabwe	*41.0*	*41.0*	*6.2*	*6.2*	91.9	91.9

Note: Data in italics refer to ITU estimates.
Source: UIS. Latest available data.

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